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SCIENCE-TEACHING IN THE SCHOOLS.[1]

BY WM. NORTH RICE.

THE word "schools" is here used in distinction from the higher institutions—colleges, universities and technological institutes. It will be convenient for us further to distinguish the "high schools" from the lower schools. As here used, the phrase "high school" designates a school whose pupils range from thirteen or fourteen to seventeen or eighteen years of age, and which professes to prepare students for the colleges and scientific schools.

In considering what should be the course of study in the schools, it is necessary to recognize the distinction in scope and spirit between general and special education. By general education is meant such education as is intended to prepare a person for the duties of manhood or womanhood, irrespective of any particular trade, profession, or station in life. By special education is meant such education as is intended to prepare a person for some particular trade, profession, or station in life. The courses of study in the schools must be, in this sense, general. We are not to try in the schools to make biologists, geologists, nor chemists. We are not to make physicians, nor engineers, nor lawyers, nor clergymen. Very few of the children in the schools will enter any of these professions; and, of that few, still fewer are aware of their destiny. But all the children in our schools have the expectation of growing up to manhood or womanhood. They will take their places in the

[1] Address at the meeting of the American Society of Naturalists, in New Haven, Conn., December, 1887, by William North Rice.

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ranks of those who earn an honorable livelihood by honest labor, or among those whom vice or improvidence renders a burden to society. Those of one sex, by the possession of the right of suffrage, and those of both sexes, by their share in that informal and unregulated vote which we call public opinion, will in their degree shape the institutions of the land. Most of them will marry, and, by the direct effect of heredity, and by manifold influences of conscious and unconscious education, will mould the character of future generations. All of them must make individually the momentous pilgrimage through this mortal life to the solemn mysteries beyond. The arrangements of the schools must be adapted to the common needs of humanity, not to the peculiar tastes and conditions of individuals. There must be one course for the children of the rich and the poor, the learned and the ignorant. Such an average course will not be the best for every child, but it will be the best practicable for the great body of children. To employ private tutors, and adapt the educational course to the supposed tastes or needs of each individual child, is impossible for the poor, and generally undesirable for the rich. The advantage to the child from being in a class of reasonable size, feeling the stimulus of intellectual competition, and learning the truly democratic lesson that only personal merit can win, is worth (except in case of children of feeble health or very peculiar constitution) far more than any advantage which can come from the adaptation of the work of a private tutor to the child's idiosyncracies. In regard to the necessity of a uniform course of study, the high schools form a partial exception. In the high schools it becomes practically necessary to provide two courses of study—one for those who are preparing for the classical courses in the colleges, the other for those who are preparing for the scientific courses in the colleges and technological schools, or whose schooling is to be finished with the high school. To a limited extent, also, elective studies may be introduced into the high school course.

In the past, two theories have been maintained in regard to the proper aim and spirit of a general educational course. The disciplinary theory is that the object of general education is to train the mental faculties, it being assumed that a vigorous and well-disciplined mind is the best preparation for all work that may be

required of a man. The practical theory is that the object of education is to furnish the necessary information for the guidance of one's conduct in all probable circumstances. Of late it has been recognized that these views are not mutually exclusive, and that a true theory of education must combine the two. The shield is both gold and silver. A right education must be both disciplinary and practical.

But this harmonizing of the once hostile theories has not been effected without important modifications of each. On the one hand, the advocates of the disciplinary theory have come to recognize the truth that mental discipline can be obtained not merely from the study of some two or three subjects, but from the study of almost any subject. It is coming to be admitted that, from the disciplinary standpoint, the important question is not what we study, but how we study. The very same mental faculties may be disciplined, and disciplined in ways remarkably similar, in dealing with the most widely different subjects. The reasoning by which the comparative philologist traces the evolution of languages is strikingly analogous to that by which the comparative anatomist traces the evolution of organic structures. On the other hand, the advocates of the practical theory have been compelled to a broader and higher view of utility than the merely bread-and-butter view. The individual man is at once body and soul; and he comes into relations with the material universe, with his fellow-men, and with that unseen Power wherein nature and man alike live and move and have their being. Whatever may be known or believed with reasonable probability in regard to the human body, and in regard to the laws of that material universe with which it is related,—in regard to the human mind, whether as self-revealed in consciousness, or as indirectly manifested in literature and history—in regard to the Creator, whether made known by the facts of nature, or by a historic revelation—all this aggregate of varied knowledge and belief is in the highest and best sense practical, for it all tends to guide the conduct of life.

The claim of any particular branch of study to a more or less prominent position in the curriculum of the schools must accordingly be tried by a twofold criterion—its power to afford an effective mental discipline, and the practical utility of the information which it conveys.

It would be obviously a waste of time to discuss the practical utility of the sciences of nature. In this age of steam and electricity—this age of aniline dyes and anæsthetics and antiseptics—this age when science is multiplying comforts and conveniences and amenities, stamping out zymotic diseases, and largely increasing the duration of the life which it beatifies and ennobles—no one is so stupid as to deny the utility of scientific knowledge.

A few words may with propriety be said in regard to the disciplinary value of the study of the natural sciences, for in some minds still lingers the superstition that no studies are disciplinary except languages and mathematics.

The natural sciences are unique in their power of training the perceptive faculties. When these sciences are rightly taught, the student is brought face to face with natural phenomenon, which he is required to observe and describe. The perceptive faculties are not, indeed, the highest of human faculties, but they are by no means to be despised. A student who has learned to observe and describe correctly so simple a matter as the form of a leaf, has gained a power which will be of lifelong value, whatever may be his sphere of professional employment. If the student is required to write descriptions of observed phenomena, there may be gained incidentally a discipline in perspicuity and precision of expression, which will be of no trifling value.

The natural history sciences afford an unrivaled training to the powers of comparison and classification. Sometimes, indeed, these sciences have been called distinctively the classificatory sciences. They have been (at least since the publication of Darwin's epoch-making work) vastly more than mere classifications. They are truly dynamical sciences, revealing the processes whereby organic nature has attained its present state. But they are nevertheless in a very important sense classificatory sciences. In no other class of subjects has classification been so minutely elaborated. No student can learn to marshal the array of species into genera, families, orders, classes, and sub-kingdoms, as men are marshaled in the companies, regiments, brigades, and divisions of a well-disciplined army, without acquiring a more systematic habit of thought on any subject which may engage his attention. But the elaborateness of natural history classification is not the only feature of value in this

connection. The student is continually taught to distinguish not only degrees but kinds of resemblance and difference,—to distinguish those features of structure which are adaptive and superficial from those which are typical and fundamental,—to distinguish analogies from homologies. No one can learn to recognize the mammalian character of a whale under the disguise of its fish-like form, or to recognize the crustacean character of a barnacle under the disguise of its oyster-like shell, without becoming in general a sounder thinker.

The sciences of nature afford a valuable discipline to the reasoning faculties. Educators have always endeavored to afford a two-fold training in reasoning—a passive discipline, by requiring the student to familiarize himself with examples of reasoning recorded in the works of great thinkers; and an active discipline, by submitting to the student problems for solution, which, if not new to the human intellect in general, are at least new to the intellect of the particular student. The study of mathematics has always, and deservedly, been highly esteemed for the facilities which it offers for both these kinds of training. But the sciences of nature also have their splendid examples of reasoning. An intelligent study of Darwin's "Origin of Species" is perhaps not inferior as a logical praxis to the study of elementary geometry. Indeed, in one respect the former is superior, for the reasoning of natural sciences is more nearly akin than that of mathematics to the reasoning of practical life. And the sciences of nature have their problems in which the reasoning faculties of the student may find an active discipline. Every laboratory experiment should be an exercise in reasoning as well as in observation. A logical interpretation should be required as much as an accurate description of the phenomena. Moreover, the continual inculcation of the doctrine which is the very key-note of science—the doctrine that there is no such thing as chance—that all events are linked together in chains of cause and effect—is itself an education in philosophical thinking and in rational acting.

Not to be ignored is the influence of the natural sciences on the esthetic nature. There are indeed some scientific men—animated cases of dissecting tools and locomotive microscopes—who can contemplate nature without admiring her. But, for most of those

whose attention is attracted to nature, her aspect is multiform, and her speech many-tongued. And the devotee of nature's truth is ever delighted with the rich stores of nature's beauty. It is no mere accident that the same generations of mankind that have developed the sciences of nature have developed two new arts—landscape-painting, and the poetry of nature. There is inspiration for the imagination, as well as satisfaction for the understanding, in the contemplation of that far-reaching reign of law which is at once the fundamental postulate and the crowning induction of science. The old myth of the music of the spheres is only a parable of the all-pervading harmony of natural law.

Nor is the study of science without its wholesome influence upon the moral nature. Science is indeed no patent panacea for human depravity; but no one can become imbued in any measure with the spirit of science—the spirit of unselfish, courageous, reverent truth-seeking—without some degree of moral uplifting. I believe that a comparative study of biography will show that flagrant immorality has been exceedingly rare among scientific men—much rarer than among men of equal intellectual eminence devoted to literature, art, or almost any other pursuit. Literature and art may express and incite the basest passions. Science—truth—is never impure.

The claim of natural science to a prominent position in the educational course is now pretty fairly conceded in the higher institutions of learning. The most conservative of the colleges are making liberal provision of instructors and of material facilities for the teaching of the sciences, and the student is required or allowed to devote a large share of his time to this class of studies, while numerous scientific schools are open for those students who wish to devote a still larger share of their time to scientific study. The case, however, is very different in the lower schools. Somewhat of science is usually taught in the high schools, though not, as a rule, to those who are preparing for college. But in the lower schools there is usually little or no teaching of science. The result is that those whose educational course ends before they reach the high school (the great majority of the population) receive no instruction in science whatever, and those who receive a college education (the destined intellectual leaders of their generation) receive no instruction in science until a very late period in their educational course.

This exclusion of science from the early stages of education, and (for the great majority of the population) the consequent utter exclusion of science from their educational course is, I believe, the worst feature of our present system of general education. The introduction of science into the lower schools is the educational reform most urgently demanded.

One important reason for this reform is implied in what has been already said. If any knowledge or appreciation of science is to be generally diffused in the community, it must be by the introduction of instruction in science in the lower schools. Of the scholars who enter the primary school, only a small part reach the grammar school, and a far smaller part reach the high school. When we consider that the "people are destroyed for lack of knowledge"—that the preventable mortality due to simple ignorance of hygienic laws exceeds the slaughter of the bloodiest campaigns;—when we consider that not only is the duration of life lengthened, but its comforts and means of higher development prodigiously increased, by scientific knowledge;—when we consider that each man's knowledge or ignorance may not only affect for weal or woe himself and his own family, but may involve results whose ramifications in space and time are beyond our ken:—we cannot fail to recognize the importance of providing for all our population the means of gaining some acquaintance with those branches of knowledge on which the welfare of humanity so largely depends.

Another reason for this reform, though less obvious, is perhaps even more important. A sound system of education must take account of the natural order of development of the mental faculties. Nor need we be in any doubt as to what that order is. The perceptive faculties are the earliest to be developed; later come into activity the powers of abstract thought; later still does consciousness become reflective, and reveal the world of mind. The attention of a healthy and normally developing child is given almost exclusively to the phenomena of the external world. The questions which he asks his parents and other adult friends (if he has not been snubbed too many times in such questioning) relate almost exclusively to objects of sense around him. There are, indeed, miraculous children who speculate about the nature of the soul almost before they molt the long dresses of babyhood; but such

children usually die of precocious genius or early piety on the brain, and may therefore be disregarded in any discussion of general education. Young children in process of normal development are what some one has called the Buddhists—"unconscious materialists." They do not disbelieve in a spiritual world; they ignore it.

The early development of the perceptive faculties produces in the young child's mind a natural curiosity in regard to sensible objects, and therefore a natural aptitude for their study. There are three ways in which we may deal with this mental tendency. First, we may leave the child's curiosity about the external world to unrestrained and unguided indulgence. We may let the child run wild through field and forest, chase butterflies, rob birds' nests, and fill his pockets with caterpillars. He will grow up a young savage, with somewhat of a savage's field-craft and wood-craft, but with very little of valuable intellectual development. Secondly, we may repress the child's natural curiosity. And, in fact, that is about what is usually done. The child is taught to read as early as possible, and then the idea is sedulously inculcated that reading is the straight and narrow way that leadeth unto intellectual life. The story of Sir William Jones's mother answering all her son's questions with the words, "Read, and you will know," is told with express and implied enconiums upon her wisdom and her son's consequent vast erudition. Verily, the ghost of that good woman haunts our schools like a malignant spirit. The climax of success is reached when the little monk is snugly cloistered with his books, oblivious of the very existence of a world of light and music around him. And if he grows up to be one of the favored few who are permitted to enter the sacred precincts of the college, and there take up the long-deferred study of nature, he finds too often his powers of observation well-nigh atrophied by long disuse. I speak strongly, because I speak from experience. I feel daily that the efficiency of my work as a student and teacher of science is impaired by that vice of early education which repressed, rather than developed, whatever powers of observation nature had given. My professional life has been a perpetual struggle to rid myself of some of the mental habitudes induced by an unnatural education. I have not yet quite freed myself from the influence of Sir William Jones's mother. And what I have felt in myself I have seen in my students. It is

worse than making bricks without straw, to teach natural science to college juniors and seniors, in whom disuse has wrought so complete an atrophy of the powers of observation that they hardly know that there is an external universe.

Manifestly, the only right course in education is to furnish intelligent and sympathetic guidance to the child's natural curiosity. The study of nature should be introduced at the beginning of the educational course, instead of near its end. It should commence—not in the primary school, but in the nursery, before the child is old enough to go to school at all. A vast deal of knowledge may be smuggled into the child's mind without paying any duty of conscious toil. And such smuggling is forbidden by no laws of God or man. No child is hurt by knowing too much; though many a child is hurt by learning things in unnatural and unduly laborious ways. Whatever of useful knowledge a child gets while he thinks he is playing is clear gain. The sentiment,

"No profit grows where is no pleasure ta'en,"

may not be strictly true, but there is at least an important truth in it.

Some years ago I had the pleasure of a somewhat intimate acquaintance with a boy who, in his third summer, became very much interested in flowers, or, as he called them, "sowers," for at that time his language, besides being very scanty in vocabulary, presented some marked dialectic peculiarities. Having obtained some specimens of the tawny day-lily (*Hemorocallis fulva*), he noticed the long slender bodies in the middle of the flower, and he asked his mother what they were. It seemed almost absurd to be teaching botany to a baby hardly more than two years old, but his mother, having large faith in the general principle that the best way to answer a child's questions is to tell the truth, told him that the things he had found were the stamens and pistil. Of course the baby did not know much about the objects which he examined. It was not time for his brain to be disturbed with matters of morphology and physiology. It was not time for him to learn that stamens and pistils are peculiarly modified leaves, or that they are respectively the male and female organs of reproduction. But his eyes were often busy that summer in looking for the stamens and pistils in various flowers, and in that simple matter of observation

he succeeded quite as well as some college juniors I have seen. And when, in after years, the time came for him to take up the study of botany more systematically, the objects of his study were to him not dim and unreal phantoms, but familiar friends.

To be continued.

FIGURING AGAINST WEEDS.

BY BYRON D. HALSTEAD.

THE weeds are among the worst enemies of the farmer. They cause a loss of many millions of dollars annually to the State of Iowa. This is not only in the diminution of crops but no small share of the outgo is in labor in order to prevent an entire loss of the crop.

Some persons, who as yet have secured no world-wide reputation for keen common sense, are inclined to look with much favor upon weeds. To their visionary minds they are simply a proper stimulus for the profitable tillage of the soil, and therefore may be considered as the friend instead of the enemy of the progressive farmer. If it were not for the weeds, which spring up and choke the neglected crop, there would not be sufficient incentive to good husbandry. Good and poor farming would be more equally rewarded. The man who hoes and the one who leaves his corn field for the shade and game along the wooded stream would stand a common chance of plenty at the harvest time. In short, weeds are the appointed means of putting a premium upon farm industry and furnish one reason why it does not pay to be shiftless.

This is turning the curse into a blessing, and if every one would practically make this turn there would need to be but little more said.

Weeds are a good deal like the sun and the rain in relation to the just and the unjust, with perhaps this variation, that the weeds seed abundantly on the neglected land of a shiftless farmer and these same seeds find their best places for growth in the clean rich fields of the careful husbandman.

But all this aside; it is true that the State of Iowa has already more weeds than she wants for the purpose of premiums. Her good farmers get enough encouragement for being good without having their less prosperous neighbors loaded down with a heavy weight of thieving weeds. I for one would be willing to risk the quality of Iowa agriculture if every vile weed within our borders was rooted out and all their seeds burned to smoke and ashes.

The conditions which surround our prairie farming, foster the growth of weeds. Land has been very cheap and at the same time very rich. The first fact has encouraged a spirit of carelessness on the part of the farmer and the second has permitted the rapid multiplication of rank weeds. As a result our State is becoming almost overrun with plant-pests of both the field and the garden.

The time has come when an earnest study must be made of the weeds which rob our land, already losing much of its virgin fertility. We must come to the rescue while the enemy is comparatively weak. Education is more effective than legislation. It is not difficult, perhaps, to pass a law against cockle-bur, beggar's lice, Canada thistle, etc., as has been done in many States, but an act of the legislature does little good until there is a keen appreciation of the importance of clean fields and road sides, already in the minds of the farmers.

With a view to becoming better acquainted with the weeds and useless plants of the State, a list has been prepared which embraces: (1) all the worst weeds, (2) the bad weeds, and (3) the indifferent weeds. The first class includes fifty-one (51). In the second group are ninety-four (94) kinds; and among the indifferent sorts are one hundred and fifty-two (152) species. This gives a total of two hundred and ninety-seven (297) distinct kinds of plants of no great usefulness to the farmers of the State, half of these a positive disadvantage and over half a hundred being pests of the worst sort. When thus arranged the enemy makes a long and bold front.

If we look at these enemies in the light of their term of life—as the horseman would say, look in the mouth, it is found that eighty-four (84) are annuals; twenty-seven (27) are able to live two years at the most, while one hundred and eighty-six (186) are perennial, that is, thrive for an indefinite term of years. These figures can be readily thrown into a tabulated form suitable for the blackboard, thus:—

	Annuals.	Biennials.	Perennials.	Total.
Worst weeds	28	6	17	51
Bad weeds	34	12	48	94
Indifferent weeds	22	9	121	152
Totals	84	27	186	297

If we look up the pedigree of these pests it will be found that they are divided into eighty-seven (87) foreigners, which have come from abroad to infest American soil. The large balance of two hundred and ten (210) are natives and are weeds in their wild state or have made inroads upon cultivated land. Of the 87 foreigners, forty-four are annuals, that is, running through their whole life in a single season, twelve (12) are biennials, and thirty-one (31) are perennials. Twenty-eight of the eighty-four are in the worst class, thirty-seven in the bad group, and twenty-two belong to the indifferent order. A table of the imported species may be constructed as follows:—

	Worst.	Bad.	Indifferent.	Total.
Annuals	18	19	7	44
Biennials	3	6	3	12
Perennials	7	12	12	31
Totals	28	37	22	87

Taking up the 210 native species in the same way, the table stands as follows:—

	Worst.	Bad.	Indifferent.	Total.
Annuals	10	16	14	40
Biennials	3	6	6	15
Perennials	10	35	110	155
Totals	23	57	130	210

From these tables it will be seen that of the worst class—which of course most interests us, there are twenty-eight foreigners to twenty-three native species. It is no comfort to know that more than half of our most aggressive weeds have come, or been brought, to us from some other country. If there is any satisfaction in the thought, it may be here stated that some inoffensive American plants have gone abroad and became dreadful pests in their new surrounding. In this way we compensate in part for the additions made to our list of weeds from European and other lands.

Beginning with the foreign annuals the leading worst kinds given in the order of arrangement in Gray's Botany, are: charlock or yellow mustard, shepherd's purse, corn cockle, purslane, abutelon or velvet leaf, sun-flower, mayweed, Jamestown or jimson-weed, two species, goose-foot or lamb's quarters; pig-weed, tumble-weed, chess and three kinds of fox-tail grass or "puss-tail."

The three foreign biennials are the common carrot, parsnip and the hound's-tongue. Two of these are closely related and have escaped from the vegetable garden where they are very important root crops. The carrot and parsnip are not as bad weeds in Iowa as they have become in many parts of the East where they cover the pastures and meadows with useless herbage.

Of foreign perennials the leading worst sorts are Canada thistle, dandelion, rib-grass or narrow-leaved plantain, butter and eggs, toad-flax or ramstead weed, curled-dock and sorrel.

Coming now to the native weeds of this most injurious class we find among the annuals the following: Daisy fleabane, great rag-weed, Roman rag-weed, cockle-bur or clot-bur, beggar's ticks, horse nettle, beaked horse nettle, prostrate pig-weed, knot-grass and bur-grass. It will be seen at a glance that this is a formidable array of bad enemies.

The biennials are the evening primrose, a kind of fleabane or horse-weed, and the viper's bugloss or sometimes called blue devils. This makes a strong three-horse team.

Of the native perennials may be mentioned the callirrhoeä, two kinds of iron-weed, three sorts of thistles, namely: the ball thistle, common thistle and pasture thistle, the bracted bind-weed and quack or quick-grass.

By turning the figures of the tables to further service, it may be shown that there are nearly twice as many foreign weeds of the worst sort as of the natives. Twenty-eight out of the fifty-one live for only a single year. Six only are biennials and seventeen are perennials. This we should not expect because other things remaining the same a perennial is a worse weed than an annual. But other things do not remain the same. The annual is usually characterized by great capacity for forming seed, and this advances many of the annuals to the first rank among plant pests. For example, the common purslane will mature a million seeds in a

single season or enough to thoroughly stock a country with this pest. A student made a careful estimate of the seeding capacity of a single plant of the small veronica, called niclace speedwell, and found that the number of seeds was 186,292. These figures help to force home the thought that weeds, and especially these sorts which are dependent upon seeds for their continuation, are exceedingly prolific, and also the importance of keeping such pests from maturing their offspring.

When asked to select the most offensive among the worst weeds the task becomes an exceedingly difficult one. Among the annuals, especially in gardens, the purslane or "pusley" perhaps takes the lead. In striking contrast with the prostrate purslane is the shrub-like Jamestown weed or stramoniums, sometimes called jimson weed. The rank herbage and heavy order of these coarse weeds, as well as their larger size, make them conspicuous and disagreeable. The pig-weeds and the closely related tumble-weed are common coarse intruders into the tilled ground.

Of the biennial the most to be dreaded are the carrot and the fleabane, both of which, in their own widely different way, can do much to render the life of the farmer vexatious.

The worst foreign perennial, at least the one with the most meanness in its make up, is the Canada thistle. At present it is but little known in many parts of the State; but it spreads rapidly by means of its airy floats which bear the light seed for long distances, and when once established in the soil it holds its place with an almost undying grip. The long perennial roots strike Iowa deep into the soil while the prickly herbage defies the attacks of foraging animals. The curled-leaf dock also takes a firm hold and is eradicated only by being dug up by the roots and hung in the sun or burned. Of the native perennials there are various sorts of coarse thistles and the celebrated quack or quick-grass. This last is a remarkable instance of propagation by undergrown stems. Plowing and harrowing only aids in the spread of this pest. Each piece of wiry stem when given any sort of a chance will grow and develop the weed.

As a rule the weeds of all classes should never be permitted to mature their seed. With annuals this is a quick and effective means of eradication. The biennials will perish at the end of the

second year. Perennials may live on for several years but if they are not allowed to develop much herbage and no flowers the old plants will gradually die of starvation and, being without heirs, they will leave the land to revert to its rightful owners.

Proper tillage will keep the weeds within safe bounds in the open fields of hoed crops. By proper tillage is understood that culture which the crop demands even when no weeds encumber the soil. The hot-bed for weeds is the neglected corners where the cultivator and hoe do not naturally go. It is in such places, along road-sides, barn-yards, open wood lots and fence corners that weeds sneak in and bear their young. It will be difficult to keep the cultivated field clean when all around is breeding ground for foul seeds.

Rome was not built in a day and neither will our weeds be destroyed in a generation. It is only hoped that, as all roads lead to Rome, so may all the inward desires and open acts of every producer of crops tend toward the destruction of our worst weeds.

THE CENTRAL PHILIPPINES.

BY J. B. STEERE.

(Concluded from page 626.)

AFTER much enquiry for a suitable place to collect in, we heard of virgin forest in the north part of the island of Panay, and finding a little steamer running up the coast we took passage to the village of Concepcion, some twenty miles north of Ilo Ilo, and nearly in front of the curious conical island called Pau de Assucar. Woods were in sight, but we found that they were steep and rocky, and difficult to hunt in, and rather unproductive of forms new to our collections, most of the birds being identical with those already procured in Guimaras. The forest had a curious half-dead appearance, which was due in part to most of the leaves having already, in January, fallen, preparatory to the coming spring, and in part to much of the timber having been injured by large gashes in the trunks to collect the gums from them. Before we left the place some of the trees were already showing the purple and bright yel-

low tints of the new foliage. Spring does not come all at once, nor to all plants at the same time, here; but I think that even here in the tropics every plant has its annual period of rest from growth, of leaf-shedding, and of spring, though there is no long period of time, as with us, between the last two processes, the new growth here usually crowding off the old leaves, though a few species, like some of the wild figs, are bare for some time before the appearance of the new leaves. These have in some instances led us to believe them dead from their bare appearance among the universal green.

The country along the coast at Concepcion was hilly and unproductive, and uncultivated, and it was a mystery how the people existed, until we followed the roads leading back into several large level valleys which had been brought under cultivation, the lower parts, which could be flooded, to rice, and the higher to sugar cane. A few Spaniards and Mestizos had settled here, and were hauling their new sugar in buffalo carts to the coast for shipment. We passed several great sheds which served as sugar-mills, the machinery being in some cases upright wooden rollers turned by buffaloes, in others, small steam engines imported from England. On the wet rice grounds, now grown up to weeds and grass, we shot a few rare water fowl, among them the great blue and purple heron of the Philippines. At a village on one side of one of these valleys we found a roost of fruit bats. Three or four acres at one side of the roadway, grown up to scattered clumps of bamboo, and in the bending tops of these the bats were clustered. The immense masses of small prickly branches, at the bases of these clumps, curve downward, and make thickets hard for man or beast to pass over or through to the trunks beyond, and they appear to be chosen by the bats for this reason.

We passed at least four distinct species of fruit bats inhabiting this grove, though each species was found by itself in particular trees. As we approached them, about noon, they hung, in perfect quiet, head downwards, by both hind feet, the wings being folded about the body so that they looked like clusters and strings of great pendant birds' nests. They were accustomed to the people of the village passing beneath them, and paid no attention to us until we began to shoot among them, when they rose squealing

into the air. After wheeling around like spectres over our heads for awhile, they would approach a perch, and throwing the hind feet forward, would grasp it, and fall down into their accustomed position. After they became alarmed they would take flight at our approach, and they appear to see fairly well by day. A few shots were sufficient to fill two large baskets, and made a good load for a native who carried them back to town. The next day, while skinning them, we had frequent visits from the villagers, who carried off the bodies to eat. They have a strong, disagreeable, bat odor, but are said to be good eating. The larger species were from fifty-four to sixty inches in spread of wing, the smaller ones about forty. They fly to great distances in their search after food, leaving their roosts at dusk and returning just at daylight in the morning. They become a great pest to the natives, though they may be benefactors in disguise, by nightly visiting the bamboo cups in the coco trees in which the sweet juice of the flower stems is being collected for *tuba*, the beer of the country, as the people are fond of calling it. Sometimes the bats take this when it is too much fermented, and the next morning finds them rolling about on the ground under the coco trees instead of on their way to their roosts, and there they are at the mercy of any crow that wishes to tear holes in their wings with his beak, or of the swine that make a meal of them. We were brought several which were caught drunk. From an examination of the stomachs of those collected, this coco juice seems to be their chief food, and must in time have its influence over their anatomy.

Having completed our work in Panay and Guimaras, we embarked again on the 1st of February, and running down around the south end of the great island of Negros, landed at Dumaquete, a clean little town just opposite the southern point of Cebu, and so near that island that we could see the trees across the strait. The south end of Negros had appeared, as we passed around it, a great stretch of grassy plains and hills, now dry and yellow, and being burned over in some places. The mountains approached nearer at Dumaquete, and we could see forests on their heights. They were volcanic, and what we judged to be ancient lava streams extended down from a height of two or three thousand feet to near sea level, and with such an even grade that they looked like gigantic railroad embankments.

We found at low tide a great number of beach-inhabiting birds on the flats north of Dumaquete. There were many species of curlews, plovers, stilts, sandpipers, oyster catchers, etc., all in flocks and most of them probably migrants. After we had procured all of these we wished the party divided. Three of us took a native boat and sailed across to the little island of Liquijor, where they made a good collection of birds, two or three species of which appear to be peculiar to the island. They also found sea shells abundant, and among other rarities procured a living pearly nautilus. The rest of the party went north along the coast of Negros and the strait of Tañon, and stopped at the village of Sibulau, near the foot of the mountains. Birds were abundant in the wooded ravines, but though we procured many species we had not seen in Panay and Guimaras, they were apparently such as depended upon a more favorable location, and not upon a real change of habitat, for the hornbills, woodpeckers, tailor-birds, pittas and sun-birds, which we had learned to look upon as test species, were identical with those from the islands named.

Hearing of some unexplored mountain lakes to the west of us, we made a trip inland in search of them. At a height of fifteen hundred feet we reached virgin forest, among which were fine tree ferns in abundance. The whole country was steep, but the natives were plowing in and cutting off the timber from the steep mountain sides, and planting them to *abaca*, the so-called Manila hemp. This is a species of banana, and looks so much like those planted for their fruit that we had difficulty at first in distinguishing them, but the abaca thrives best in a cool and moist situation. We found it afterward growing luxuriantly at a height of three thousand feet, while those varieties used for food thrive best near sea level and in the greatest heat. Like the other bananas, the abaca forms a trunk from eight to twenty feet high, made up chiefly of the bases of the leaves, these wrapped one over the other, and it is these which are made use of. They are torn apart, and the outer covering of the outer or convex side is stripped off. This contains the fibre, the the rest of the leaf base being made of large watery cells. It is drawn through a wide machine made on the spot by the Indian cultivator. This has wooden jaws, between which the watery cells among the fibre are torn and pressed out while the fibre is drawn

through. The hemp comes out white and glistening, and requires no other preparation but drying to fit it for baling and shipment. Through the fall in price of sugar, hemp is now the most important article of export from the islands.

We reached a height of three thousand five hundred feet, the path leading for most of the way along the narrow crests of mountain ridges. Oaks were plenty at these heights, and with them Indian pitcher plants, a beautiful colored leafed begonia, a colens in in flower, and a great number of ferns, and mosses. Everything was dripping with moisture, and land leeches were crawling over the ground or hanging from the plants ready to drop upon us. The lakes were small—one a half mile, and the other perhaps a mile in length, and at a height of about three thousand feet. They were in steep ravines between mountains, so that there were no valleys about them in which we could hunt. A step from shore on any side took us over our heads in water. Deer and wild hogs were abundant, and our Indian hunters tried to drive them into the lakes with their dogs, but without success. The only life we saw in the water of the lakes was leeches, of great size, and crabs and water-fowl were almost absent. A few great hornbills were flying from one mountain crest to another, but it was folly to attempt to follow them.

We found a little piece of level ground at the mouth of a mountain brook, where we built us a shelter and camped. We shot a few species of flycatchers from the trees over our hut, and after staying two days, and sleeping cold with the themometer 67°, we descended to the coast. While some of the party went on to Cebu by steamer, a division crossed the strait of Tañau to Cebu, and followed the west coast of that island to the town of Barili, then crossing the mountains to the east coast followed this to the north until we reached the city of Cebu. This is the oldest Spanish town in the islands, and is the capital of the island and a port open to foreign trade.

We found the island of Cebu still more thoroughly stripped of its timber than the islands to the west, but after doing what we could to get a fair collection of its birds we concluded that it, too, belonged zoologically with Negros and Panay. A brief visit by two of us to Bojol convinced us that this, too, must go with the islands to the

west of it in a division which may well be called the Central Philippines. Bojol and Cebu have large amounts of limestone rock thrown up in steep ridges, and this has probably caused their great richness in land shells, of which each valley seems to possess a species. The shallow strait between these islands is rich in sea life, and a week spent in the little island of Waiming produced a fine collection of corals, echinoderms and sea shells. Crinoids were abundant in the shallow water, and of several species; they were usually partly protected among the branches of living corals, but sometimes fastened, mouth upward, to stones and coral masses. An immense spiny star-fish was slowly crawling over the coral stems, digesting the polyps as he went, and leaving a broad white track of dead coral behind him. Returning to Cebu, we packed our collections, and left them to be forwarded by sailing ship to New York, and took passage on the last of March for Saman and Leite, the most eastern islands of the group.

THE DERIVATION OF THE DOMESTIC POLLED BREEDS.

BY R. C. AULD, F. Z. S.

(Continued from page 509.)

WHAT part had these polled cattle of the parks in the origin of the existing domestic breeds of Britain, now so numerously represented in this country? Instances have been enumerated of the existence in widely scattered places of polled cattle of various descriptions. Out of all these did any survive and become aggregated more into certain localities, and thence evolved into separate and distinct breeds? The connection of the park cattle with these breeds of polled cattle in their former and present state will here be traced.

Sir Richard Owen, in advocating his theory as to the origin of British cattle, which is at variance with that of Darwin, Lyell, Nilson, Rütimeyer, etc., says: "Had the *Bos primigenius* been the same we might have expected the Highland and Welsh cattle to have retained some of the characteristics of their great progenitors,

and to have been distinguished from other domestic breeds by their superior size and the length of their horns. The Kyloes and the runts are, on the contrary, remarkable for their small size, and are characterised either by short horns, as in the *Bos longifrons*, or the entire absence of these weapons."

With all due respect to Sir Richard, exception must be taken to his ideas as to the characterisation of the Welsh and Highland cattle. Has he ever seen either race at the Smithfield Show at London, or other National Shows, or on their native heath? If he had he would not have fallen into the error of characterising these cattle as of small size, or short horned, or wanting in the characteristics of their progenitors, the Uri. If he had seen them as they may be seen, he must have been convinced that they do possess the strongest claims to such descent of any existing race, in respect of size, length of horn, and general characteristics. This is the common error that many have fallen into, not having seen representative or real specimens of the breed. How many animal forms have not large and small associated varieties or species? This needs no illustration. Besides, "size" depends not always on species, but on environment. That these small and large Scotch horned correspond respectively with *longifrons* and *urus*, we believe, however, is true.

Contrast with Owen's ideas the practical knowledge of Professor Low. In his "Domesticated Animals" he says: "These English White Forest breeds have merged in the common breeds of the country." He believes, however, that the same animals are yet to be found in that part of the Kingdom where we should naturally look for the existence of an indigenous race of cattle, *viz.*, beyond the Severn, in Wales, and in the West Highlands.

"The mountain breeds of Scotland," he says, "are identical with those which formerly inhabited the woods of that country, which, we have seen, were the ancient Uri, and which we may term the White Forest breed." He has also some excellent remarks on the comparative size of the Urus and his modern representative, which are too long to quote. But he says: "The size of the Pembroke cattle is that of the larger class of the breed of the West Highlands of Scotland"—which corresponds with all practical breeders' knowledge on the subject.

We may leave Low here with the following quotations: "Thus we have all the evidence which the question admits of, that no real distinction exists between the wild oxen of the parks and those which have for ages been subjected to domestication in the same country, and that these wild oxen are no other than the Uri of the ancient forests of Europe."

"Thus were the Uri of the Scottish forests driven from the woods which they inhabited, destroyed, or made captive. Part, indeed, had been preserved in some of the religious houses, their flesh being more esteemed than that of 'their ain tame bestial.' But with the destruction of the ancient establishments, the oxen were dispersed, destroyed, or mingled with the common races. In a few places only they seem to have been preserved without intermixture—chiefly in the parks of the Dukes of Queensberry at Drumlanrig, and of the Dukes of Hamilton, at the Chace of Cadzow. Those at Drumlanrig were, many years ago, destroyed by order of the late Duke of Queensberry. Those at the noble park of Hamilton are yet in existence, preserved with care." He describes them as "indubitably descendents of the ancient race," and as to their size says they are in that respect the same as the cattle of the West Highlands.

For convenience I continue from last chapter the consideration of the Scottish parks. And it is necessary in this investigation to examine these somewhat closely, so as to obtain a proper definition of their limits, and to exhibit the direct connection they had with the polled breeds of to-day.

Sir W. Jardine, Bt., (Naturalists' Library, Vol. IV.), makes these remarks in describing the "White Urus, or Hamilton Breed of Wild Cattle": "The Caledonia Sylva, or Caledonia Forest, extended from Stirling through Monteith and Strathorne to Athol and Lochaber. It is described by old authors as dividing the Picts from the Scots, and, being well furnished with game, especially with the fierce white bulls and kine, it was the place of both their huntings and of their greatest controversies. The Roman historians delight much to talk of the furious white bulls which the Forest of Caledonia brought forth. . . . . At what period the present breed was introduced to the royal chase at Cadzow cannot now be well ascertained. It is well known that the Cummings [Earls of Buchan] were at one period proprietors of Cadzow and Cumber-

nauld, and it is likely that in their time the white cattle were in both places. But, be that as it may, they have long been extirpated in Cumbernauld, while they have been preserved in great perfection at Hamilton."

This description of ancient "Caledon," given by Jardine correctly from the earliest historians, should be remembered. For, more latterly, authorities, even such as Sir Walter Scott, described the Caledonian Forest as extending over a territory of which "Cadzow and Chillingham are but the extremities," "which in ruder times was a continuous forest, the white cattle being the remnants of those herds of *Tauri sylvestres*, described by early Scottish writers as abounding in the forests of Caledonia."

This latter region, as a look at any map showing the boundaries of the different regions in these early times [1] will show, was the ancient Strathclyde—the western portion of southern Scotland and northern England, the adjacent portions on the eastern side of England and Scotland being Northumbria, while "Caledonia," so says the writer in the Encyclopædia Britannica, "lies to the north of the Forth," but must include the region of the Clyde which flows north. This Caledonia in the west—called Dalriada—came to be inhabited by the Irish Scot or Gael, while the east remained Pictish. These Dalriadans were the *great* Scots about whom historians have had so much to do. The Galloway, "Wild Scots," were afterwards conquered by the true Scots of Dalriada, the name Galloway not indicating the composition, but the conqueror, of the Pictish inhabitants. The Pict, that is, of the east or northeast, "came from Scythia—that is, North Germany—as their own legends tell, which was undoubtedly peopled by Celts before it was peopled by Germans."

Let us, then, look at the park herds in Scotland—the Hamilton, the Ardrossan, the Drumlanrig. The first is located in the great Caledonian region defined by Jardine, Storer, Harting and others, as above. The two last belonged to ancient Galloway. The Ardrossan and Drumlanrig (Duke of Buccleugh) were *horned;* the Hamilton was *polled.* The significance of these facts will appear when the history, literature and philology of the two regions are examined.

[1] See Skene's "Celtic Scotland."

The parks became enclosed in ancient times, and with the enclosing the wild cattle became enclosed also. These cattle were the Uri of the north, whose originating source was the ancient cattle of Cumbernauld, near Stirling. These then became extinct, having been scattered, part being preserved in the polled cattle of Hamilton.

"The wild bull of the north had, therefore, anciently free access to the whole of southern Scotland, and to the mountains, wastes and forests of northern England also."[1] The Cumbernauld extinct herd "thus connects north and south; the wild bull of the old Caledonian Forest north of Stirling with the Hamilton wild cattle, and with those which inhabited, as described by Scott, the continuous mountain ranges and the innumerable forests which formerly extended from Hamilton to Chillingham." Hamilton was thus near the fountain-head. Their representatives at Cadzow, and over the north, were polled. This territory was the pasture region of the polled cattle of Fife, Angus, Aberdeen, etc. At Drumlanrig, in the pasture ground of the Galloway, they were horned—in that indicating the character of the original Galloway breed.

Take now the Hamilton cattle possessing as its hunting ground all northward. These were the famous white bulls of Caledon, descended, as all authorities agree, from *Bos urus;* and which were also by all historical accounts polled. This herd belonged, before the days of the Bruce, to the Cummings—the great but unfortunate Earls of Buchan.

But further, Hamilton Palace was the seat of the Douglas-Hamiltons, Dukes of Hamilton and Brandon, who represented through the male line the great Douglases, Earls of Angus. Here, therefore, we have the Hamilton (Cadzow) herd connected in the closest manner with the shires of Aberdeen (Buchan) and Angus. Hence are traced the roots of the Aberdeen-Angus breed of polled cattle, firmly spread over the more lowland portions of the Caledonian region. And it is a further historical fact that it was from royal Kildrummy, in Aberdeenshire, after his spoliation of the Cummings, that King Robert the Bruce, in the thirteenth century,

[1] See "Wild White Cattle of Great Britain;" *also* "Domesticated Animals of Britain."

issued to hunt the wild bulls of the Caledonian forest, which region extended thus from royal Kildrummy to royal Stirling.

The origin of the name Caledonian is derived from the word *Calder*, signifying the hazel brush. In the Transactions of the Highland Society, Vol. XVII., 1885, it is stated that in Lanarkshire, in which the Hamilton herd is situated, "fifty years ago some had cows of the native or Calder breed; others crosses with these and Ayrshires." The word *Kyloe*, also, is derived from the name of this forest region, the word meaning *cows of the woods*—both words having one root in common.

The Drumlanrig and Ardrossan herds are extinct. These herds were horned [the latter having latterly become polled on the introduction of polled bulls from Hamilton.] And just as the Aberdeen-Angus had their roots in the Caledonian polled varieties represented by the Hamiltons, so had the Galloway its foundation from the same horned cattle that became enclosed at Drumlanrig.

Drumlanrig Castle, in Dumfriesshire, is located in the valley of the Nith, between Hamilton and the Firth of Solway, but nearer the latter. The owners of this castle were that branch of the house of Douglas which enjoyed successively the titles of Earls, Marquises and Dukes of Queensberry. The Duke of Buccleugh, as heir general, is Duke of Queensberry, and possesses Drumlanrig.

While, as will be seen, Hamilton was transferred to the Angus-Douglases on the extinction of the Comyns by Bruce, Cumbernauld, likewise owned by the Comyns, became transferred by Bruce to Sir Robert Fleming, who was the ancestor of the Earls of Wigton, and it was probably during the time of Queen Mary, when the Flemings were out of favor at court, that the remnants of the Cumbernauld herd got dispersed, and some might have been transferred to Dumfriesshire.

Anyhow the Drumlanrig herd also went by the name of the *Wild Caledonian Cattle.* They were white with black points. Mr. Dickinson, in his Essay "On the Farming of Cumberland," published 1852, identifies the Drumlanrig cattle also with the Caledonian Forest Wild Cattle. The herd has been long extinct. Drumlanrig was located at the foot of these wild hills, which extending throughout southern Scotland, were the ancient haunts of the Scottish bull. "Castle Dangerous," which Scott describes as among

the mountains which gave shelter to the wild bull, is not far off. These horned cattle, mixed with the local *Bos longifrons*, probably gave origin to the modern breed of cattle of that region.

It was in the late Duke of Buccleugh's knowledge that his favorite race of Galloways—of which he was the champion—was, up to the middle of last century, a horned race; and he, true conservative, deplored the change. Perhaps the change had been wrought in a similar manner to that of the Ardrossan herd; or by some influence of the territorial magnates on their acquirement by political means of a connection with a country containing among its wild cattle many of the polled variety.

The climate of Galloway region is described by writers on the breed, explaining thus the coarse hair that is a characteristic of the Galloway, as very humid. And we see also the result of this humidity in the coarse horns of the historical breed.

Darwin quotes Prof. Low as to humidity of climate producing hair in abundance; and Youatt has also stated the correlation between coarse hair and horn. "We can thus see how a humid climate," says Darwin, "might act on the horns—in the first place directly on the skin and hair, and secondly by correlation on the horns." While the Galloway men themselves explain the finer coat of the Aberdeen from "*the drier*" climate.

And there is an absolute dearth of any collateral evidence, derivable from local literature, philology, sculpture, etc., to indicate the *non-existence* of horns in this ancient breed; the tradition, as will be shown, being that they were anciently universally horned.

Aberdeen-Angus Breed.

As the lowlands of the Caledonian region belong entirely to the counties associated with this breed, and as the breed from the earliest times was the same foundation, the maol Kyloe, the Hamilton polled, the dodded of the Meigle sculptured stones, the homyls of King Kenneth's time, and the hornless neat of T. Kirke, etc., must be accepted as the progenitors of this world-famous race of cattle. Formerly everything connected with the history of the breed was wrapped in obscurity—they being an unknown breed (to the outside world) in a *terra incognita*. I have in this investigation brought forward here what is new or of such importance as the subject required.

Investigators, in their researches into the history of this breed, have been chagrined to find in the first or second of the Surveys of the County of Aberdeen, drawn up for the Board of Agriculture, that no mention is made of any of the native breeds as being horn-

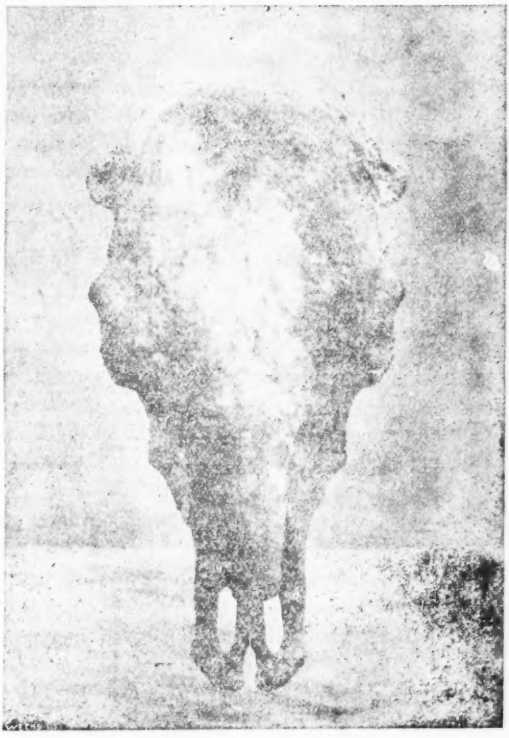

FIG. 1.—Skull (in possession of the author) of the imported Aberdeen Angus prize bull Justice (1462), 8 years old, died on the property of Judge J. S. Goodwin, Beloit, Kansas. Height of skull, 20 inches. (From a photograph.)

less. This, now, is regarded as remarkable, and more so for the reason that the author of the first Survey was a man of considerable repute, Dr. James Anderson. The first series of these surveys were, however, written chiefly from the strict agricultural point of view. The live-stock was undesignedly overlooked. So much, however, did this prove to be the case that a second series was

organized for the purpose of rectifying the mistake. There were about ten years between the two series.

The first Survey of the Agriculture of Aberdeenshire, by Dr. James Anderson, of Monkshill, in the Buchan district, was published in 1794. The author never mentions *horn* or *hornless* in describing the two breeds that come in for notice. One of these can, however, be identified with the old long-horned Aberdeenshire breed, described as being fine and rich milkers; the other, mentioned as the cattle of Buchan, which can be identified by the evidence of his own household as the native low-country polled Buchan. He gives good general testimony to the high character of the latter.

James Anderson, LL.D., was born near Edinburgh, 1730; died in London, 1808. He farmed extensively in the Buchan district of Aberdeenshire. He was a voluminous writer, and is thus referred to by Darwin ("Variations of Animals and Plants," second edition, Vol. I.): "Another ingenious writer, though not a naturalist, with a bold defiance of everything known on geographical distribution, infers that the sheep of Great Britain alone were the descendants of eleven endemic British forms!" Yet he was quoted largely by others. Having resided so long in Buchan, it seemed incredible that such a man, such a ready observer, even though not a naturalist, should have escaped noticing, in some way, the special peculiarity—as hornlessness was apparently to him—of the cattle of that region, named, indeed, from that peculiarity itself, Buchan *Humlies*, from time immemorial. So it appeared to the general student. But, for the reasons mentioned, it appeared to me that he must have made some such allusion. So I carefully examined all his works likely to contain anything of the nature sought. In his "Recreations in Agriculture and Natural History, etc.," completed in six volumes, I find him descanting thus (p. 67, Vol. I., published 1799, "On Varieties of Animals: an enquiry into the nature of that department of Natural History which is called Varieties among Animals, etc., with some cursory hints upon the same term as applied to Vegetables"): "If a chance individual be produced that is of a large size, or particular make of body, the descendants of that individual, if mated with one having similar peculiarities, will be of the same kind. The same thing will happen if it have a

tendency to fatten more kindly, to yield a greater or smaller quantity of milk, to lay fat on a particular part of the body, to produce more or less tallow, to be more or less hardy, or any other peculiarity. Even accidental blemishes may thus be perpetuated. If a hornless individual be born of a hornless breed of creatures,[1] this may give rise to a whole tribe of hornless beasts of that kind, which will propagate their like with as little deviation as takes place in the original stock. If a kind of creature that usually carries two horns chance to produce one with three, four, or six horns, you may thus obtain a breed having many horns. Thus we are able to account for those families or breeds of domestic animals which differ in regard to certain particulars of the kind above specified, and which, when once introduced [or appearing] into a certain district, have a tendency to continue themselves in that district for a great length of time if considerable pains be not taken to alter it. The means of altering such a breed are, however, from the facts here stated, clear and obvious; nor can it be effected with certainty but by a change of blood, or an intermixture of breeds. If the qualities of the peculiar breed are excellent, the means of improving it are equally obvious, the selecting of the best individual of that breed, and which have the wished-for qualities in a higher degree than the ordinary, to breed from; and, if they be done with ease and judgment, its effect will be certain and by no means liable to any kind of doubt." The reference in the Index to the above passage is: "Hornless breeds of cattle, how produced." The above affords a good deal. In the first place Dr. Anderson regarded cattle without horns a *blemish*. This would prove that he was unacquainted with any other polled breeds, if such there were, in Scotland. If he had, he would not have been able to regard it as a blemish. Secondly, that these polled creatures had *continued in that district for a great length of time*, and had occurred indigenously previously to his advent in the country at any rate, which would take us back to the beginning of the century (1700).

[1] I would direct attention to the use of this word *creatures*, which sounds so peculiar to an old country man, and to the new comer to this country, for I found it used pronounced "*critturs*" to describe cattle. Thus in America the original usage of the word is maintained, like so many others. Indeed, as I show, from the Index reference, Dr. Anderson uses the word, also, to describe cattle.

Thirdly, he was one of a number (it will be seen, from the means he recommended, at that early date, to eradicate a blemish) who were doing their best to obliterate the old native polled race of such a good quality. He was isolated in Buchan, with only the Buchan Polled breed before his eyes, surprised at the want of the horns he found there to be indigenous, and thus attempted to explain an "isolated" instance, as he thought it; whereas, if he had had a wider acquaintance with the innumerable polled races that had existed in all time, he would have attempted some more scientific explanation—one which I may say here, remembering Darwin's allusion to him, has escaped or baffled that prince of naturalists himself.

But the "hornless breed of Buchan creatures" survived the attempt made to obliterate the blemish which had existed for such a length of time, up till 1799, and which had now been setting the fashion for all breeds. Dr. Anderson's overseer, who began to deal in 1801, has recorded the existence of polled cattle in Buchan during Dr. Anderson's time, and since then they have become the most famous of polled races.

Now I have brought Dr. Anderson into line, and made him yield testimony to the early existence of the polled cattle of Aberdeenshire, which is about the most important piece of evidence that has been produced on this subject, and is most interesting.

The Galloway Breed.

Up to about the beginning of the last quarter of last century the Galloway cattle were horned, and during the middle of that century were "universally" so. The earliest certain account of them as polled is given by Marshall, who wrote in 1782. He says that *the best* were at that date mostly polled. Andrew Wight, in 1746, mentions them more promiscuously.

The late Sir B. T. Brandreth Gibbs, Hon. Secretary of the Smithfield Club, etc., etc., as General Superintendent of the British Agricultural Section of the Paris Universal Exhibition of 1878, in the "Short Introductory Notes on Some of the Principal Breeds of Cattle, Sheep and Pigs," written by him and prefixed to the Catalogue of the British Section, says: "Occasionally some have small 'slugs' or stumps, which are not affixed to the skull." Dr. Flem-

ing, 1812, wrote similarly about the existence of these "slugs" then, and is quoted by Boyd-Dawkins as evidence of the *last appearances* in this ancient breed of a reminiscence of its former character. But Youatt *twenty years later* notices them, and in 1878 Sir B. T. Gibbs also. The above facts are of scientific interest, showing the transformation of an ancient race from the horned to polled state. Professor Boyd-Dawkins has likewise favored me with the following notes :—

"The only historical account of the origin of the British polled cattle with which I am acquainted is in the letter of the late Lord Selkirk to which you allude. Lord Selkirk was a man of remarkable ability, and one of the best of the Scotch lairds, and is not likely to have made any important slip. I have no doubt that his account of the breeding out of the horns is substantially accurate, so far as relates to the Galloway cattle. Moreover, on referring to Youatt, p. 155, I find incidental evidence that Lord Selkirk is right."

"Oral testimony," says Mr. David McCrae, author of a history of Galloway cattle, "handed down to these men from the Galloway breeders of last century, is valuable and reliable." So the letter from the late Earl of Selkirk, F.R.S., written to Prof. Boyd-Dawkins is of particular value. Boyd-Dawkins in introducing it says: "The polled or hornless cattle of the present day have undoubtedly been derived, through careful breeding, of the horned cattle. The Galloway breed has lost its horns principally through the care of the grandfather of the present Earl of Selkirk, to whom I am indebted for the account given in full below. Some fifty or sixty years were consumed in bringing this animal to its present shape and form." The letter is as follows; it is dated March 6, 1867 :—

"I have no distinct written record about the way the horns of the Galloway cattle were 'bred out,' as we cattle-breeders say. The breed 150 years ago was not generally polled, *i.e.*, without horns, though there was always a good many polled ones amongst them. Polled ones are found in every breed. My informant was an old man who died about thirty years ago, he being then nearly ninety. He was the son of the man who tended the cows of my grandfather, and had been employed among cattle all his life; in his old age, while still able to work, he tended my cows. His

name was James McKinnan, and he was a man whose recollections seemed always remarkably clear. He had been with cattle as far as Norfolk, to St. Faith's fair; he told me that in the days of his childhood, a Norfolk feeder, who bought many of the Galloway cattle, fancied those without horns, and would give 2*s.* 6*d.* or so more for a polled than a horned beast. This set the fashion, and the people began first to look for polled bulls, and none other; then they preferred polled cows, etc., to breed from, and thus the change was effected in, I believe from fifty to sixty years. The horns of the Galloway beast were very ugly, drooping, and as thick at the point as at the root. I have myself seen one or two beasts with horns like that; but nowadays, when horns appear they are generally traced to some with a cross with the Irish breed. Those that are born polled have a lump in the centre of the forehead, which is very hard, and will break another bull's skull for him."

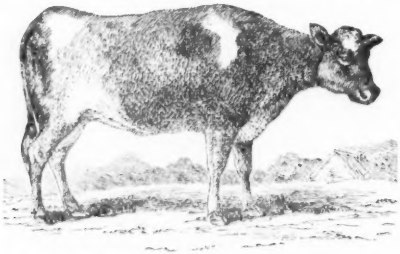

FIG. 2.—"Galloway Heifer exhibited at Lord Somerville's cattle show, 1806."—From the *Complete Grazier*, 1816.

The late R. Gibson, Assistant Curator of the Museum of Science and Art, Edinburgh, Scotland, in the article "Cattle," in the last edition of "Encyclopædia Britannica," arranges British cattle into three classes: "(1) Polled cattle, an artificial variety, which may be produced by selection; thus, the polled cattle of Galloway had small horns so late as the middle of last century, but by only breeding from bulls with shortest horns, the grandfather of the present Earl of Selkirk succeeded in entirely removing these appendages." Gibson was arguing from the history of only one instance.

Aiton, in his Survey of Ayrshire, 1813, says: "According to tradition, the Galloway cows were, in ancient times, uniformly provided with horns."

There were numerous introductions of foreign blood into Galloway; to give an instance: "Admiral Keith Stewart lately introduced [into Galloway] a beautiful Argyllshire bull, which he considered to have made the greatest improvement of any on the country breed" (Agr. Rep. of Galloway, p. 22). That does not look as if the breed was polled. And Aiton says, "Stories were told of bulls being brought from England—north and west—which banished their [the Galloways'] horns for them." Some also think that it was on the introduction of the Irish *moyl* that the polled character dates. As Gilbert shows, there was a continuous interchange of cattle between the border counties of England and Scotland. And,as shown by Storer, Low, and the early historians, and ourselves, the tendency of cattle was continually from the north of Scotland to the south, and not *vice versa*. So that it is difficult to trace a straight line descent for the Galloway, as can be done for the Aberdeen-Angus, whose country was never so invaded. The latter were the real ranche cattle of early Britain, and were the first to open up the highways from the north to the south.

The Norfolk and Suffolk Red Polled Breed.

This East Anglian breed of polled cattle is an amalgamation between the "old Norfolk" horned race and the "old Suffolk" polled. The latter could hardly escape having "acquired its hornless character from contact with the white variety maintained at some of the old establishments in the district," *i.e.*, the herds of polled cattle in the parks already described. It was not till 1846 that there had been such an amalgamation between the old Suffolk with the old Norfolk as to entitle the two varieties to be recognized as one breed. There is in the lobby at Raynham Hall a picture of Starling, a cow of the old Norfolk breed, in the thirty-sixth year of her age, which preserves to us the apparent character of this old breed.

Mr. R. E. Lofft gives the following account of the evolution of this race:—

"The origin of the present breed of Red Polls is perfectly well known. About a hundred years ago the native cow of Norfolk, a variety peculiar to the county, of a red color, with a white face, and horned, was crossed with the Suffolk polled bull, with a view,

mainly, no doubt, to improve the milking qualities of the breed, as well as to do away with the horns. Since then this old Norfolk breed seems to have died out. But the old Suffolk breed survives pure in one peculiar variety—a cow of golden yellow. Of course there are various shades of this color, but the real golden yellow is, to my mind, the most beautiful of all colors; it is sometimes seen in horses, though but very rarely. Indeed, I do not recollect to have seen more than three or four in the course of my life. However, this color is not popular in cows of the Red Polled breed, nor, indeed, I believe, among Short-horns. Perhaps the reason for this is that a pale washed-out yellow, which often occurs, gives a feeble look to an animal.

"Of the old Suffolk breed, no one pretends to have traced the origin. Perhaps, in some future day, some of the numerous old manuscripts that are being reproduced in print may throw some light on the history of this animal—at present it is purely conjectural. The balance of probability would point to this kind of cattle being derived from the old white breed with black or red ears and muzzles. Polled cattle of this description were formerly to be found in various parts of Suffolk and Norfolk, and some small remnants remain to this day. The transition from white to yellow would not appear to be difficult. The pictures of J. Ward, the eminent cattle and landscape painter, furnish numerous instances of the prevalence of this breed, both polled and horned varieties, whether from an artistic preference, or from an actual preponderance of the type, it is hard to say. I have, myself, two oil paintings by this master, one of which contains a polled and the other a horned cow of the white breed, with red muzzle and ears. The breed with black ears and muzzles and more striking in appearance from the strong contrast in color; indeed, it is hardly possible to find anything prettier than a young calf of this kind. In the National Gallery there is a large landscape of a Yorkshire scaur, with groups of cattle. In the foreground stands a white bull of very massive proportions, ears and muzzle being of a light red.

"The earliest descriptions of Suffolk cattle speak of them as of various colors, some cream or yellow, some brindled; others, again, as red; some as mouse-colored, or a kind of blue, but none of them as black—in this respect differing from the Scotch Kyloes, one of

the oldest, if not the oldest, breed of cattle in the British Isles. It is certainly not a little peculiar that none of the writers of that day mention black Suffolks, more especially as some of the Suffolks had been crossed with Galloways—a breed in which black certainly predominates. No doubt, at times, red Galloways have been produced from pure-bred black parents, and some were said by Youatt to be of a dun or drab color. However, I am not inclined to accept the evidence of color as a sign of purity of race."

Mr. Youatt has given it as his opinion that the Red Polls are descended from the Galloway breed; but after a careful and impartial examination of the records bearing on the subject we are inclined to believe with Mr. Euren, editor of the Herd-book, that in the several varieties of Red Polled cattle we have the descendants of the ancient breed valued by our ancestors for their large yield of milk. This explanation of the derivation of the breed is the more probable when it is remembered that since 1765 there have been domesticated herds of white polled park cattle in Norfolk, they having in that year been taken to Gunton, in Norfolk, from Middleton Hall, where they were maintained in a wild state long prior to 1697. These Gunton polled cattle and their offshoots became domesticated in Norfolk, were multiplied in the county, and it is almost certain that to them is chiefly due the distribution of a polled breed over the county. Arthur Young, in his survey of Suffolk, dated 1792, remarks that the cattle there "were universally polled—that is, without horns." Files of the *Norfolk Mercury* show that in 1774 there were whole dairies of polled cattle in the county. It is clear that the Galloway cross was also introduced; but there is distinct proof that polled cattle existed in considerable numbers both in Norfolk and Suffolk prior to the date when the Galloways themselves became generally polled.

We read in the *Norwich Mercury* of 1770 advertisements of polled cattle, both bulls and cows, to be sold near Cawstown, Peepham and Pullham market. In 1802, advertisements for the Red Polled cattle were very numerous.

These Galloways are distinctly stated to have been for purposes of feeding, simply; and that they were not used for creating a hornless variety out of already hornless cattle is evident from the total want of similarity between them, not only in color but general

resemblance. The two breeds are totally dissimilar. If there is any resemblance in general contour and appearance between the Suffolk and Scotch Poll, it is to the Aberdeen-Angus, and not the Galloway. Photographs or engravings of these two breeds are strangely similar, and might be taken for either breed, except, in reality, the color and size; while pictures of Red Polls and Galloways could be distinguished at a glance. As Mr. R. E. Loftt points out, in a letter he has favored me with, "black and red are convertible colors, red Galloways being every now and then produced from pure-bred black sire and dam." But whoever heard of a *black* Suffolk polled cow?—which would be bound to appear once in a while if the breed owed any origin to a black polled breed. So that "an investigation of even a very limited nature is sufficient to convince any one that the theory has been properly exploded," "that a breed of cattle, themselves hornless from their earliest origin, needed a cross with another hornless breed in order to make them polled."

I have carefully examined all the earliest authorities on the counties of Norfolk and Suffolk that could be expected to throw light on this subject. These authorities are: *Norfolk*—Nathaniel Kent, "General View of Norfolk," 1794; William Marshall, "Rural Economy of Norfolk," 1787; Arthur Young, 1804. *Suffolk*—Arthur Young, "General View of Agriculture of Suffolk," 1794; and the following: Culley, "On Live Stock"; John Lawrence, "Cattle," 1805; and Richard Parkinson, "Live Stock," 1810. The particulars given by these authorities need not be repeated here. Suffice it to say—as these notes are only required to go so far as will establish the correct origin of the polled breeds—in none of these county reports is there any evidence to support the assertion that the Red Polls owed any origin to the Galloway Scot; in fact, "no allegation had ever been made in such well-informed quarters" to such effect. Culley appears to have been the genius who "discovered" this supposititious origin for a breed already polled, and Lawrence, Parkinson, Henderson, Youatt and others have been content to serve up the same old fable without examination—thus leaving a legacy of error to the Galloway historian, to his own detriment.

As to the claims of the Galloway, therefore, as being the origin

even in part of the Suffolk, or any other polled race which were polled before they were, the position may be illustrated thus: To the name given to a certain garden weed, coltsfoot, whose flower appears before the leaves, hence called "the son before the father." To the ideas expressed in the Rig-veda.[1] Indra is the principal god of the Veda, who made Heaven and Earth, and the account of whose origin is that he had "begotten his own father and mother from his own body." "Indra begat his parents" is exactly the parallel of the claims of the Galloway.

The above may be said to be all that is known at present in the best-informed quarters. I now am able to produce the last and most conclusive item of testimony to this already well-forged chain. This is derived from the "palæontology" of language; by the existence, in the good old times, of a word used in Suffolk to name the polled cattle of the locality. That word was *mooly*, meaning *a polled cow*. It was in use, according to old English philologists, during and previous to 1750, as will be shown in the chapter on Philology. This will illustrate the value of philology as a source of evidence. It occupies a similar and as exact a position as "the testimony of the rocks." That the word was of Suffolk use in England and was a household word in those days is incontestible. It is therefore curious to know that it seems extinct now, or unknown to such a widely informed student as Mr. G. Gilbert, for in answer to my query he informed me he was totally unaware of any local or provincial word used in the way indicated. The very near equivalents of the word, as in the Irish and Gaelic *maol*, and north of Scotland *mooly*, will be commented on again, and they suggest important reflections.

The fact of the use of this word in these days in Suffolk is proof sufficient of the great antiquity of the cattle the word described—an antiquity much greater than of a breed that never had any such cognomen—as the Galloway.

But I offer another proof of the worth of this link of evidence as satisfying our requirements in that respect. Let us jump over to America. What do we find? That this same word *mooly* is in

[1] The Cosmology of the Rig-veda. By H. W. Wallis. Published by the Hibbert Trustees. Williams and Norgate, London.

India, What does it Teach us? By Max Müller. Funk and Wagnalls.

universal, living, use to describe the polled cow in all her various forms.

Mr. Euren, in his history of the breed in the Red Polled Herd Book, Vol. I., very evidently was perfectly unconscious of the fact of the claims of the word *mooly* to being an early Suffolk provincialism. If he had, how more positive would have been the remarkable query he makes—showing how close his "speculation" came to real exactitude;—note he uses marks indicating the "foreign" use of the word: "'Muley' cattle have been in Virginia for a great many years, and their descendants have also been uniformly polled. . . . It would be of value to the students of the history of cattle were search to be made respecting the introduction of polled stock into America. It is recorded that many of the earlier settlers were natives of Norfolk and Suffolk villages. May they not have taken over polled cattle, which at that day were so numerous in Suffolk and on the Norfolk borders?"

He does not suggest that these settlers, if they did not—the first of them—take polled cattle, took the word *mooly* with them; and, finding that the cattle there, of various origins, then or subsequently introduced, frequently coming polled, applied the word to them they had been accustomed to.

HISTORY OF GARDEN VEGETABLES.

BY E. LEWIS STURTEVANT, M.D.

(Continued from page 433.)

Ice Plant. *Mesembryanthemum crystallinum* L.

THE ice plant, from the Cape of Good Hope, was introduced into Europe in 1727.[1] It is advertised in American seed lists[2] of 1881 as a desirable vegetable for boiling like spinage, or for garnishing. Vilmorin[3] says the thickness and slightly acid

[1] Noisette. Man., 1829, 538.
[2] Thorburn's Cat., 1881.
[3] Vilmorin. The Veg. Gard., 1885, 275.

flavor of the fleshy parts of the leaves have caused it to be used as a fresh table vegetable for summer use in warm, dry countries. It is, however, he adds, not without merit as an ornamental plant.

It is called in France *ficoide glaciale, glaciale;* in Germany, *siskraut;* in Flanders and Holland, *ijsplant, ijskruid;* in Italy, *erba diacciola;* in Spain, *escarchosa, escarcha.*[1]

Italian Corn Salad. *Valerianella eriocarpa* Desv.

This species occurs in gardens in two varieties. It has a lighter green, somewhat longer leaf than the ordinary corn salad, slightly hairy and a little dentate on the borders towards the base.[2] It has the same uses. It is described for American gardens in 1863.[3] Under its common name *grosse mache* it is noticed in France in 1829, and also as *mache d'Italie* in 1824.[4]

Called in France *mache d'Italie, regence, grosse mache;* in Germany, *italienischer ackersalat;* in Holland, *italiansche koornsalad.*

Valeriana coronata Willd. is occasionally grown abroad as a salad plant under the name of Italian corn salad.

Jerusalem Artichoke. *Helianthus tuberosus* L.

This plant was cultivated by the Huron Indians,[5] and was in use by the New England Indians at an early period.[6] It reached Europe in the early part of the seventeenth century, as it is not mentioned in Bauhin's Phytopinax, 1596, and is mentioned in his Pinax, 1623, where, among other names, he calls it "Chrysanthemum e Canada quibusdam, Canada & Artichoki sub terra, aliis." It is figured by Columna[7] in 1616, and also by Laurembergius[4] in 1632, and Ray,[8] 1686, is the first use I have found of the name Jerusalem artichoke, but Parkinson uses the word in 1640, according to Gray. In 1727 Townsend[9] says it "is a Root fit to be eat

[1] Vilmorin. Les Pl. Pot., 1883, 218.
[2] Vilmorin. Les Pl. Pot., 1883, 325.
[3] Burr. Field and Gard. Veg., 340.
[4] Noisette. Man., 1829; L'Hort. Fran., 1824.
[5] Asa Gray. Am. Agric., 1877, 142.
[6] Pickering. Ch. Hist., 749.
[7] Columna. Minus cognit. stirp. pars altera, 1616, 13.
[8] Laurembergius. Apparat. Plant., 1632, 131.
[9] Townsend, seedsman, 1726, 23.

about Christmas when it is boil'd"; Mawe,[1] in 1778, says it is by many esteemed; Bryant,[2] in 1783, says, "not much cultivated." In 1806 McMahon[3] speaks of it in American gardens, and calls it "a wholesome, palatable food." In 1863 Burr[4] describes varieties with white, purple, red and yellow-skinned tubers.

The Jerusalem artichoke is called in France, *topinambour, artichaut du Canada, A. de Jerusalem, A. de terre, crompire, poire de terre soleil vivace, tertifle, topinamboux;* in Germany, *erdapfel, erdbirne;* in Flanders, *aardpeer;* in Denmark, *jordskokken;* in Italy, *girasole del Canada, tartufoli;* in Spain, *namara pataca;* in Portugal, *topinambor, batata carvalha;*[5] in Bengali, *bhramoka, soorjyamookhee.*[6]

The history of the Jerusalem artichoke has been well treated by Gray and Trumbull, in the *American Journal of Science,* May, 1877, and April, 1883. It was found in culture at the Lew Chew islands about 1855.[7]

We offer a synonymy as below:—

Flos Solis Farnesianus sive Aster Peruanus tubercosus. Col., 1616, 13.
Helianthemum indicum tuberosum. Bauh. pin., 1623, 277.
De Solis flore tuberoso, seu flore Farnesiano Fabii Columnæ. Aldinus, 1625, 91.
Battatas de Canada. Park. par., 1629, ex Gray.
Adenes Canadenses seu flos solis glandulosus. Lauremb., 1632, 132.
Flos Solis pyramidalis, parvo flore, tuberosa radice, Heliotropium indicum. Ger., 1633.
Peruanus solis flos ex Indiis tuberosus. Col. in Hern., 1651, 878, 881, ex Gray.
Potatoes of Canada. Coles, 1657, ex Phillips.
Canada & Artischokki sub terra. H. R. P., 1665, ex Gray.
Chrysanthemum latifolium Brasilianum. Bauh. prod., 1671, 70.
Chrysanthemum Canadense arumosum. Cat. H. L. B., 1672, ex Gray.
Helenium Canadense. Amman., 1676, ex Gray.
Chrysanthemum perenne majus fol, integris, americanum tuberum. Mor., 1630, ex Mill dict.
Jerusalem Artichoke. Ray, 1686, 835.

[1] Mawe. Gard., 1778.
[2] Bryant. 1783, 33.
[3] McMahon. Am. Gard. Cal., 1806.
[4] Burr. Field and Gard. Veg. of Am., 1863, 39.
[5] Vilmorin. Les Pl. Pot., 561.
[6] Perry's Jap., ii., 44.
[7] Birdwood. Veg. Prod. of Bomb., 165.

Corona solis parvo flore, tuberosa radice. Tourn., 1719, 489.
Helianthus radice tuberosa esculenta, Hierusalem Artichoke. Clayton, 1739, ex Gronov.
Helianthus foliis ovato cordatis triplinervus. Gronov. virg., 1762, 129.
Helianthus tuberosus. Linn. sp.. 1763, 1277.

Kale. *Brassica oleracea acephala* D C.

The kales represent an extremely variable class of vegetable, and have been under cultivation from a most remote period. What the varieties of cabbage were that were known to the ancient Greeks it seems impossible to determine in all cases, but we can hardly question but that some of them belonged to the kales. Many varieties were known to the Romans. Cato,[1] who lived about B. C. 201, describes the Brassicæ as: the *levis*, large, broad-leaved, large-stalked; the *crispa* or *apiacon;* the *lenis*, small-stalked, tender, but rather sharp-tasting. Pliny,[2] in the first century, describes the *Cumana*, with sessile leaf and open head; the *aricenum*, not excelled in height, the leaves numerous and thick; the *Pompeianum*, tall, the stalk thin at the base, thickening among the leaves; the *Brutiani*, with very large leaves, thin stalk, sharp savor; the *Sabellica*, admired for its curled leaves, whose thickness exceeds that of the stalk, of very sweet savor; the *Lacuturres*, very large headed, innumerable leaves, the head round, the leaves fleshy; the *Tritianon*, often a foot in diameter, and late in going to seed.

I have not sufficient knowledge to give a complete history of the kales. I can only review those races which I have had an opportunity of studying, and this I will make as short as possible, intending only to bring into form for further study.

I. The form of kale known in France as the *Chevalier* seems to have been the longest[3] known, and we may surmise that its names of *chou caulier* and *caulet* have reference to the period when the word *caulis*, a stalk, had a generic meaning applying to the cabbage race in general, and we may hence surmise that this was the common form in ancient times, in like manner as *coles* or *coleworts* in more modern times imply the cultivation of kales. This word *coles* or *caulis* is used in the generic sense, for illustration, by Cato,

[1] Cato. Script. Rei Rust., 1787, vol. i., p. 75.
[2] Pliny. Lib. xix., c. 41; Lib. xx., c. 33.
[3] A. P. Decandolle. Mem. on the Brassicæ, 1821, 7.

two hundred years B. C.; by Varro and Æmilius Macer in the first century B. C.; by Columella the first century A. D.; by Palladius in the third; by Vegetius in the fourth century A. D.; Albertus Magnus in the thirteenth, etc. This race of the Chevaliers may be quite reasonably supposed to be the *levis* of Cato, sometimes called *caulodem*,[2] of no medicinal use.

According to Decandolle,[3] this race of Chevaliers has five principal sub-races, of which the following is an incomplete synonymy:—

I.

Brassica lævis. Cam. epit., 1586, 248; Matth. op., 1598, 366.
Br. vulgaris sativa. Ger., 1597, 244.
Cavalier branchu. Decand. mem., 1821, 9.
Thousand-headed. Burr, 1863, 236.
Chou branchu du Poitou. Vilm., 1883, 135.
Chou mille tetes. Vilm. l. c.

II. a. viridis.

Kol. Roszlin, 1550, 87.
Brassica. Tragus, 1552, 720.
Brassica alba vulgaris. J. Bauh., 1651, ii., 829.
Chou vert commun. Decand. mem., 1821, 9.
Cow Cabbage. Burr, 1863, 232.
Chou cavalier. Vilm., 1883, 134.
Brassica vulgaris alba. Chabr., 1677, 290.

II. b. rubra.

Brassica primum genus. Fuch., 1542, 413.
Br. rubra prima species. Lugd., 1587, 523.
Br. rubra. Ger., 1597, 244.
Br. rubra vulgaris. J. Baughin, 1651, ii., 831; Charb., 1877. 270.
Red cavalier. Decand. mem., 1821, 9.
Flanders kale. Burr, 1863, 233.
Caulet de Flander. Vilm., 1883, 134.

III.

Brassica vulgaris sativa. Lob. obs., 1576, 122; ic., 1591, i., 243; Dod., 1616, 621.
Br. alba vulgaris. Lugd., 1587, 520.
Brassica. Cast. Dur., 1817, 76.
Chou a fevilles de Chene. Decand. mem., 1821, 10.
Buda kale. Vilm., 1885, 141.

IV. a.

Brassica secundum genus. Fuch., 1542, 414.
Br. fimbriata. Lob. obs., 1576, 124; ic., 1591, 247.

Br. sativa crispa. Ger., 1597, 244.
Br. crispa. Dod., 1616, 622.
Br. crispa lacinosa. J. Bauh., 1651, ii., 832.
Chou vert frise. Decand. mem., 1821, 10.
Tall Green Curled. Burr, 1863, 236.
Chou frise vert grand. Vil., 1883, 131.

IV. b.

Brassica crispa, seu apiana. Trag., 1552, 721.
Br. crispa Tragi. Lugd., 1587, 524.
Br. tenuifolia laciniata. Lob. ic., 1591, i., 246.
Br. selenoides. Dod., 1616, 622.
Br. tenuissima laciniata. J. Bauh., 1651, ii., 832.
Br. selenoides. Ger., 1597, 248.
Chou plume or Chou aigrette. Decand. mem., 1821, 11.
Ornamental kales of our gardens.

V.

Brassica tophosa. Ger., 1547, 246; J. Bauh., 1651, ii., 830.
Br. tophosa Tabernemontano. Chabr., 1677, 270.
Chou palmier. Decand. mem., 1821, 11; Vilm., 1883, 133.

These forms occur in many varieties, differing in degree only, and of various colors, even variegated. In addition to the above we may mention the proliferous kales, which also occur in several varieties. The following synonyms refer to proliferation only, as the plants in other respects are not resembling:—

Brassica asparagoides Dalechampii. Lugd., 1587, 522.
Brassica prolifera. Ger., 1597, 245.
Brassica prolifera crispa. Ger., 1597, 245.
Cockscomb kale. Burr, 1863, 232.
Chou frise prolifere. Vilm., 1883, 133.

II. *The Dwarf Kales.*—Decandolle does not bring these into his classification as offering true types, and in this perhaps he is right. Yet olericulturally considered they are quite distinct. There are but few varieties. The best marked is the Dwarf Curled, the leaves falling over in a graceful curve and reaching the ground. It can be traced through variations and varieties to our first class, and hence it has been probably derived in recent times through a process of selection, or through the preservation of a natural variation. We have now an intermediate type between the Dwarf Curled and the Tall Curled forms in the intermediate Moss Curled.

III. *The Portugal Kales.*—We have two sorts of kales that have the extensive rib-system and the general aspect of the Portugal cabbage. These are the *Chou Brocoli* and the *chou frise de mosbach* of Vilmorin. I must consider these as bearing the same relation to the Portugal cabbage that our kales bear to the heading cabbages. Of their history I have ascertained nothing.

ON CERTAIN FACTORS OF EVOLUTION.[1]

BY ALPHEUS. S. PACKARD.

SO far as we are aware, Lamarck was the first naturalist to refer the atrophy of eyes and loss of vision to disuse from a life in darkness, as may be seen by the following extract from the chapter in his Philosophie Zoologique, entitled "De l'influence des circonstances sur les actions et les habitudes des animaux, et de celle des actions et des habitudes de ces corps vivans, comme causes qui modifient leur organisation et leurs parties." This work appeared in 1809, many years before the discovery of blind animals peculiar to caves.

"Des yeux à la tête sont le propre d'un grand nombre d'animaux divers, et font essentiellement partie du plan d'organisation des vertébrés. Déjà néanmoins la taupe, qui, par ses habitudes, fait très-peu d'usage de la vue, n'a que des yeux très-petits, et à peine apparens, parce qu'elle exerce très-peu cet organe.

"L'Aspalax d'Olivier (Voyage en Égypte et en Perse, II, pl. 28, fig. 2), qui vit sous terre comme la taupe, et qui vraisemblablement s'expose encore moins qu'elle à la lumière du jour, a totalement perdu l'usage de la vue; aussi n'offre-t-il plus que des vestiges de l'organe qui en est le siège; et encore ces vestiges sont tout-à-fait cachés sous la peau et sous quelques autres parties qui les recouvrent, et ne laissent plus le moindre accès à la lumière.

"Le protée, reptile aquatique, voisin des salamandres par ses rapports, et qui habite dans des cavités profondes et obscures qui

[1] From advance sheets of an essay on Cave Animals of North America. Mem. Nat. Acad. Sciences.

sont sous les eaux, n'a plus, comme l'Aspalax, que des vestiges de l'organe de la vue; vestiges qui sont couverts et cachés de la même manière.

"Voici une considération décisive, relativement à la question que j'agite actuellement.

"La lumière ne pénètre point partout; conséquemment, les animaux qui vivent habituellement dans les lieux où elle n'arrive pas, manquent d'occasion d'exercer l'organe de la vue, si la nature les en a munis. Or, les animaux qui font partie d'un plan d'organisation, dans lequel les yeux entrent nécessairement, en ont dû avoir dans leur origine. Cependant puisqu'on en trouve parmi eux qui sont privés de l'usage de cet organe, et qui n'en ont plus que des vestiges cachés et recouverts, il devient évident que l'appauvrissement et la disparition même de l'organe dont il s'agit sont des résultats, pour cet organe, d'un défaut constant d'exercice (2d edit., i, p. 241)."

In his "Origin of Species" Darwin, after claiming that "natural selection would constantly aid the effects of disuse" in the case of moles and the burrowing rodents, then remarks in regard to cave animals: "As it is difficult to imagine that eyes, though useless, could be in any way injurious to animals living in darkness, I attribute their loss wholly to disuse" (p. 142). On the next page he writes: "By the time an animal had reached, after numberless generations, the deepest recesses, disuse will on this view have more or less perfectly obliterated its eyes, and natural selection will often have effected other changes, such as an increase in the length of the antennæ or palpi, as a compensation for blindness."

It may be that the struggle for existence goes on even in the darkness of caves, and that the "fittest" of the limited population survive by reason of their adaptation to their untoward surroundings. How adverse to life of any sort caves are may be realized when we consider that only the lowest plants, and only a very few of those, live in caves. Without doubt the germs of fungi and the seeds of the higher plants are carried into the caves by freshets in subterranean streams and through sink-holes. Why, in spite of the darkness, we should not find more fungi even, and why one or two of the *green* algæ should not flourish in the pools and brooks of caves, or why the seeds of the higher plants should not germi-

nate, even if the plants do not bear fruit, can only be explained by the absence of light; and perhaps this is an important cause of the absence of all plant life in the ocean below a depth of about 300 to 500 fathoms. Certainly there are ample means for the colonization of caves by vegetables; the temperature, moisture, and inorganic food are more favorable than the sum total of conditions on alpine summits or in the high polar regions, or in hot springs.

Animal life can apparently withstand greater physical obstacles than vegetable. As regards the struggle for existence, it possibly exists to a limited extent in cave animals. There is probably not enough vegetable or decayed animal food for all the animals, and some may die of hunger. The carnivorous beetles and Arachnida perhaps have a less favorable chance to obtain living food than the Crustacea, for the blind crayfish have a tolerable abundance of food in the Cæcidotæa, perhaps the most abundant form found in caves containing underground waters.

We may, with Darwin, for convenience, use the phrase "natural selection" to express the process by which the cave fauna was produced, but such a term to our mind expresses rather the result of a series of causes than a *vera causa* in itself. There is of course no doubt but that many animals carried by different means into caves cannot thrive there, and consequently die. It is only those which have been able, by certain peculiarities of their life in the upper world allied to cave existence, to adapt themselves to cave conditions which permanently breed there. Such forms, it is convenient to say, have been by nature selected and are successful in colonizing the darkest and most forbidding and apparently hopeless corners in the earth's crust. But such a phrase as "natural selection," we repeat, does not to our mind definitely bring before us the actual working causes of the evolution of these cave organisms, and no one cause can apparently account for such a result. There is rather a complex assemblage of physical causes, all working together, to secure a harmonious result. The most important and potent of these causes, when we study them under such appreciable, because so extraordinary, conditions as the physical features of cave existence, would seem to be the following:

1. Change in environment from light, even partial, to twilight or total darkness, and involving diminution of food, and compensation for the loss of certain organs by the hypertrophy of others.

2. Disuse of certain organs.

3. Adaptation, enabling the more plastic forms to survive and perpetuate their stock.

4. Isolation, preventing intercrossing with out-of-door forms, thus insuring the permanency of the new varieties, species, or genera.

5. Heredity, operating to secure for the future the permanence of the newly originated forms as long as the physical conditions remain the same.

Natural selection perhaps expresses the total result of the working of these five factors rather than being an efficient cause in itself, or at least constitutes the last term in a series of causes. Hence Lamarckism in a modern form, or, as we have termed it, Neo-lamarckism, seems to us to be nearer the truth than Darwinism proper or "natural selection."

The factors of organic evolution such as we have mentioned are, of course, theoretical, and the critic or unbeliever in a theory of descent demands facts in demonstration of the truth of the derivation of cave animals. Of the facts we have ourselves observed, or which have been observed by others, we will briefly summarize:—

1. The variations in *Pseudotremia cavernarum* and *Tomocerus plumbeus*, found living near the entrance of caves in partial daylight.

2. The bleaching of Polydesmus and Machilis found living in small caves; the blindness of Neotoma, or the wood-rat of Mammoth Cave; of fish found in wells and subterranean streams; the atrophy of the mole's optic nerves induced in one generation.

3. The larger size of the eyes of the young than in the adult Troglocaris of Europe, and the blind crayfish of American caves; Semper's history of the atrophy of eyes in the parasitic Pinnotheres; eyes of *Gammarus pulex* affected after living in darkness; the eyes of Gammaridæ in Lake Baikal becoming smaller the deeper they live; the instability in the eyes of Cæcidotæa.

In a small cave near White's Cave, and at a point about sixty feet from the mouth, occurred a salamander (*Spelerpes longicaudatus* Green), which was apparently bleached, being nearly white, with dark brown blotches. The common *Cambarus bartonii* occurs somewhat bleached in Mammoth Cave, and this may not be the result

of inheritance, but occurs in young hatched without the cave, and afterwards carried in so as not to be exposed to the light, the shell remaining pale as in the very young. Perfectly white, bleached specimens of the common *Polydesmus granulatus* Say, occurred in Indian Cave. The pale variety of *Tomocerus plumbeus* is possibly the product of a single or at least very few generations; the white and blind Porcellio found by Mr. Hubbard in Little Wyandotte Cave, though possibly a true cave form, has not yet been found elsewhere, and may have been the young of a normal, epigean species. But the most striking instance is the bleached specimen of *Asellus communis* from Lost River, referred to on pp. 15 and 33, which, though white, had eyes of normal size: there is good reason to suppose that these specimens were hatched in epigean waters, and that being carried into Lost River when young, the pigment in its skin, owing to absence of light, had failed to assume its normal dark color.

A parallel case is that mentioned by R. Schneider[1]:—

"The author gives an account of the subterranean variety of *Gammarus pulex* which is found at Clausthal. The first point of interest is its pale color, pigment being so completely absent from its body that it is milk-white and transparent; even the fat-cells, which are intensely red or orange-yellow in the ordinary *G. pulex*, are quite white. In the second place, the eye is not normally developed, but is in the first stage of reduction; the crystalline cones show signs of degeneration, and the whole eye exhibits that 'megalophthalmy,' or proportionately greater size which is often the first indication of loss. The pigment has also begun to be reduced, and is of a dirty black, instead of a brownish color. The anterior pair of antennæ exhibits elongation, owing to the increase in the number of the joints.

"There is, as compared with the ordinary forms, a considerable increase in the amount of calcareous deposits; and there is always a considerable amount of iron-oxide in the contents of the intestine, whence the iron makes its way to various parts of the body.

"Fries[2] suggests that experiments should be made on the effects

[1] Unterirdische Gammarus von Clausthal, P. B. Ak. Berlin, 1885, p. 1087; also, Abh. z. Programm k. Real-Gymnasiums Berlin, Ostern; Abstr. in Journal Roy. Micr. Soc. (2), vi., p. 243.

[2] Zool. Anzeiger, Aug., 1879, pp. 36, 37.

of rearing normal, eyed Gammari in darkness, and refers to Humbert's statement that in the greater depths of Lake Baikal, with an increase in depth of their habitat, there is an increasing lack of development of the eyes in some Gammaridæ. Fries also states that he himself had previously observed a decrease in the pigment of the eyes in young examples of *Gammarus pulex* living in darkness."

Here should be cited the observations of Anton Stecker, who states that Chermes, usually said to be eyeless, has rudimentary eyes, represented by clear, somewhat transparent spots, the chitin forming them being devoid of the granulations covering the rest of the shield.

"Each cornea is supplied by a large and well-developed optic nerve, proceeding from an optic ganglion in connection with the brain. But the layer of crystalline rods was wholly absent. About 30 to 35 per cent. of the specimens of *Chermes cimicoides* examined possessed these eye-spots; in the remaining 65 to 70 per cent. they were absent, as well as the optic nerves; while there was only one, or even no recognizable rudiment of an optic ganglion. He also found that the offspring of parents, both of which had eyes, were themselves provided with them; but that if either the father or the mother were blind, the young were also blind, having at most a feeble indication of optic lobes. Dr. Stecker considers this a most instructive case of the gradual atrophy of an organ by disuse owing to the influence of changed conditions. There can be little doubt that the ancestors of Chermes possessed well-developed eyes; the first steps in the retrogressive process was the loss of the cornea and cones, the optic nerve and ganglion remaining after the true percipient apparatus had gone."[1]

Here is a fertile field for careful and long-continued observations on animals reared in different degrees of darkness. Such experiments will afford a crucial test of the theory of rapid evolution of genera and species due to sudden changes in the environment.

It is evident that physiological experiments are needed as well as embryological studies, to throw further light on the origin of cave animals. The blind-fish, blind crayfish, and Cæcidotæa,

[1] Morp. Jahrbuch, iv., 279, 1878; Journ. Roy. Micr. Soc., ii., 146, 1879.

which might be reared in dark cellars, should be observed for a series of generations, to ascertain whether by breeding the eyes cannot be restored, and the species by artificial means be induced to revert to its ancestral type. The embryology of the cave beetles, with or without rudimentary eyes, of the eyeless spiders and of Myriapods, of the Cæcidotæa, and of the blind crayfish and blind-fish should be carefully worked out as regards the presence of organs of vision in a rudimentary state, though we should hardly expect to find rudimentary eyes in Anophthalmus when larva and pupa do not possess them.

Isolation as a Factor in the Origin of Cave Animals.—When any cave, such as Mammoth or Wyandotte, etc., is once colonized by emigrants from the upper world, and the colonists becoming adapted to the new conditions environing them, have lost their eye-sight, or even all traces of eyes, and the new forms thus established begin to breed true to their recently acquired characteristics, it is obvious that this process of in-and-in breeding will continue as long as the new forms live in total darkness and are isolated from the allied forms or their eyed ancestors of the upper world of light. Though a subordinate factor, isolation is certainly of no little importance in securing the stability of the new species and genera. It is evident that if no stragglers from the upper world, as species of Trechus to interbreed with the cave Anophthalmi, species of Choleva to cross with Adelops or Bathyscia, or species of Ceuthophilus to mix with the true cave Ceuthophili, or species of Myriapods or Arachnida to intercross with the cave forms, then the latter will tend to remain as fixed as we now find them to be. In the case of the crayfish of Mammoth Cave, the normal *Cambarus bartonii*, introduced at times of heavy rains or freshets into the cave, is not seldom found living in company with *Orconectes pellucidus*, the blind form, but belonging to a different section of the genus as regards the shape of its gonopods or first male abdominal appendages, and being of much larger size, it is probably incapable of fertilizing the eggs of the blind form, even if the latter, timid and sensitive to the least disturbance of the water, should allow itself to be approached by the larger-eyed form. It is also probable that *Cæcidotæa stygia* is seldom, if ever, brought in contact with *Asellus communis*, which abounds in the pools and streams through-

out the cave region. I have never found a stray Asellus even partly bleached and with diminished eyes in any caves, nor seen such specimens in collections made by others, though they may yet be found. Whether living in caves or wells fed by subterranean streams, the bleached, eyeless, or nearly eyeless, forms breed true to their type, and show no signs of intercrossing with lucophilous forms.

Should, however, these cave forms be placed in such circumstances as to be able to mix or intercross with their epigæan allies, which are in all probability the very species to which they owe their origin, there would with little doubt be a constant tendency to revert to the ancestral eyed forms, and we should constantly find certain individuals with visual organs better developed, and with a darker integument, serving as connecting links. Such links may have been common enough when the caves were first formed and colonized, and in some species, as *Pseudotremia cavernarum*, they frequently occur at the present time, but, as a rule, owing to long isolation or seclusion, and the consequent impossibility of intercrossing, they are now rare.

But as circumstances are now, the total darkness, the temperature, the degree of dryness or the moisture, and other physical conditions remaining the same, the cave fauna is almost completely isolated from that of the upper world; indeed, far more so than the deep-sea fauna of the ocean or of lakes, or the faunas of deserts or of the polar regions, or the alpine inhabitants of lofty mountain summits. We thus realize that isolation may be a not unimportant factor in securing permanence of type, after the typical characters have once been established through adaptation and heredity.

After reflecting upon the influence of isolation upon cave animals as securing permanence of varietal, specific, and generic characters, one is led to realize as never before the importance of geographical isolation in general as a factor in preventing variation after the organisms have once become adapted to their peculiar environment, whether dependent on temperature, soil, humidity, or dryness, the absence of light, or any other appreciable characteristic in their surroundings. We know also that the existing desert, deep-sea, and polar faunas are the product of Quaternary times; that they were nearly contemporaneous in origin with the cave faunæ,

though the deep-sea faunæ may date from the cretaceous period. Finally, I may quote from Darwin's "Origin of Species" the following extract, which applies (though he did not make it applicable to any special case) with peculiar force to cave fauna: "If, however, an isolated area be very small, either from being surrounded by barriers, or from having very peculiar physical conditions, the total number of the inhabitants will be small, and this will retard the production of new species through natural selection, by decreasing the chances of the appearance of favorable individual differences" (Fifth edition, New York, p. 105).

Heredity.—The action of this all-powerful factor in evolution is as constant in the underground world, and as difficult to comprehend in considering cave life, as that of the upper regions. It begins to act, of course, with the earliest generations, and continues to act with, so to speak, increasing force and precision as time goes on and the characteristics induced by a life in total darkness becomes more and more fixed.

It is evident that heredity has acted longest in those insects, such as the species of Anophthalmus and Adelops, whose larvæ are lacking in all traces of eyes and optic nerves and lobes. Heredity has here acted with unabated force throughout every stage of the metamorphosis; and, it will be a matter of great interest to ascertain whether any traces of the eyes may be met with in the embryo of these forms.

On the other hand, in those Arthropods in which the brain and optic nerves have persisted, with rudiments of the eyes (*e.g.*, Orconectes), where the eyes are larger in the young, it would seem as if heredity had been acting through a shorter period, and consequently, so to speak, with less momentum.

In the case of Machærites, in which the females only of certain species are said to be blind, while the males have well-developed eyes, we have an apparent exception to the continuous action of heredity; an exception paralleled, however, by animals living in the upper world, such as Termes, whose workers and soldiers are eyeless, though the males and females are eyed. They perhaps are twilight species rather than inhabitants of totally dark localities in caves, and those living in twilight may intercross with those

inhabiting the darker regions, and such a case as this, remarkable as it would appear, does not affect the general rule, that animals living in total darkness and never living in twilight, nor intercrossing with twilight forms, are eyeless, or at least blind.

Nor does the case of Hadenœcus, the cave cricket, with well-developed eyes and brains, affect the argument; for this is essentially a twilight form, though migrating to regions of total darkness and abounding there. The same may be said of the cave species of Ceuthophilus. A parallel case may be that of Chologaster as compared with Amblyopsis, the former living out of caves in ditches as well as in wells and caves.

Judging by the following statement, so eminent a naturalist as Professor Semper denies that heredity acts in the case of the mole. He says:

"This almost total blindness in the mole is the result solely of complete degeneration of the optic nerve, so that the images which are probably formed in the eye itself can never be transmitted to the animal's consciousness. Occasionally, however, the mole even can see a little, for it has been found that both optic nerves are not always degenerate in the same individual, so that one eye may remain in communication with the brain while the other has no connection with it. In the embryo of the mole, however, and without exception, both eyes are originally connected with the brain by well-developed optic nerves, and so theoretically efficient. This may indeed be regarded as a perfectly conclusive proof that the blind mole is descended from progenitors that could see; it would seem, too, to prove that the blindness of the fully grown animal is the result not of inheritance, but of the directly injurious effects of darkness on the optic nerve in each individual." [1]

It may be objected, however, that each mole certainly inherits a tendency to weakness and atrophy of the optic nerves, just as the children of consumptive or strumous parents inherit a tendency to those diseases, and that when the conditions are favorable the disease manifests itself. We know there have been many generations of blind or partially blind moles, and it would be strange if heredity did not at a certain age act in such a case, and would not for at least a few generations even if the moles were kept out of the dark-

[1] Animal Life, etc., pp. 79, 80.

ness. We have in the atrophy of the optic nerves of the mole a parallel case in the blind Myriapod *Pseudotremia cavernarum*, where the eyes survive but the optic nerve is wanting, as also in a less marked degree in some of the individuals of *Cæcidotæa stygia*.

The study of the conditions of existence in caves is of special value, because such conditions are so unusual and abnormal and the results upon certain organs so easily appreciated. It is by a study of life under unusual conditions that the attention is aroused and interest is excited, and after acquiring experience in dealing with the more palpable, because somewhat abnormal, circumstances under which organisms exist, we can then more easily observe the effects of changes of ordinary conditions upon the organism.

From a study of cave life, of organisms existing in saline and in heated waters, of plants and animals exposed to great cold in alpine or polar regions, of those living in hot, dry deserts, we can turn to an examination of the results of adaptation to a parasitic mode of life. The strange modifications of form, owing to disuse, in internal as well as external parasites of different orders and classes, the change of host necessitated, and the intensity of the struggle for existence in animals living under such exceptional conditions, embryology proving that they have arisen from animals of normal organization,—such studies as these are of fundamental importance in a discussion of the origin of species and higher categories. Moreover, the study of the results of the incoming and cessation of the Glacial epoch, the effects on life arising from the elevation and depression of the land, involving not only change of land surfaces, but a change of climate,—it is by a study of such marked changes as these in the conditions of life that we are prepared to examine the more subtle causes of variation throughout the organic world in general.

After the foregoing pages were written we read with much interest Mr. Herbert Spencer's recent essays entitled "The Factors of Organic Evolution."[1] While that author, it appears to us, lays too great stress on Dr. Erasmus Darwin's views, as compared with Lamarck's; the author of the Philosophie Zoologique having been a professional botanist and zoologist as well as a naturalist of the

[1] New York, 1887, reprinted from the Nineteenth Century for April and May, 1886.

first rank, it is noteworthy that he sees clearly that natural selection is not the sole factor in organic evolution, as will be seen by the general drift of his essays, by his quoting with approval Huxley's significant remark that "Science commits suicide when it adopts a creed," and by the following extracts from his own essays:—

"But now, recognizing in full this process brought into clear view by Mr. Darwin, and traced out by him with so much care and skill, can we conclude that, taken alone, it accounts for organic evolution? Has the natural selection of favorable variations been the sole factor? On critically examining the evidence we shall find reason to think that it by no means explains all that has to be explained" (p. 9).

During that earlier period, when he was discovering the multitudinous cases in which his own hypothesis afforded solutions, and simultaneously observing how utterly futile in these multitudinous cases was the hypothesis propounded by his grandfather and Lamarck, Mr. Darwin was, not unnaturally, almost betrayed into the belief that the one is all-sufficient and the other inoperative.[1] But in the mind of one usually so candid and ever open to more evidence there naturally came a reaction. The inheritance of functionally produced modifications, which, judging by the passage quoted above concerning the views of these earlier inquirers, would seem to have been at one time denied, but which, as we have seen, was always to some extent recognized, came to be recognized more and more, and deliberately included as a factor of importance.

In his references to the works and opinions of other naturalists Mr. Spencer confines himself almost exclusively to those of Mr. Darwin, who always opposed, and, it must be confessed, with less than his usual candor and fairness, the views of Lamarck as to the influence of a change in the environment upon organisms.[2]

It seems singular that Mr. Spencer should not be acquainted

[1] It is surprising to read in Darwin's Life, by his son, the expressions showing his lack of appreciation of Lamarck and his work; Darwin seems from the first to have been strongly prejudiced against Lamarck's views, and never to have done them justice.

[2] In the Origin of Species (p. xiv., note) Darwin writes, as quoted by Spencer: "It is curious how largely my grandfather, Dr. Erasmus Darwin, anticipated the views and erroneous grounds of opinion of Lamarck in his 'Zoonomia' (vol. i., pp. 500–510), published in 1794" (p. 29).

with the work of those who have brought together certain facts bearing on the physical factors of evolution.[1] The principal factors referred to by Mr. Spencer are use and disuse and the influence of light. In one place he does in concrete language sum up these agencies as follows:—

"The growth of a thing is effected by the joint operation of certain forces on certain materials; and when it dwindles there is either a lack of some materials or the forces co-operate in a way different from that which produces growth. . . . . That is to say, growth, variation, survival, death, if they are to be reduced to the forms in which physical science can recognize them, must be expressed as effects of agencies definitely conceived—mechanical forces—light, heat, chemical affinity, etc." (pp. 39, 40).

On page 70 Mr. Spencer remarks:—

"But nevertheless, as we here see, natural selection could operate only under subjection. It could do no more than take advantage of those structural changes which the medium and its contents initiated."

Again, on page 73, Spencer suggests that natural selection, in order to act, must have had a limited number of organisms upon which to operate.[2] As he remarks:—

"Though natural selection must have become increasingly active when once it had got a start, yet the differentiating action of the medium never ceased to be a co-operator in the development of these first animals and plants."

[1] In the writer's Introduction to the Standard Natural History, 1885, under the head of Evolution (pp. 1 and lxii.), he has endeavored to bring together references to the different authors who have insisted on views which are in the line of those first suggested by Lamarck, a phase of evolution which we have called Neolamarckianism. The authors to whom Mr. Spencer might have with good reason referred are, in Europe, Semper, Kölliker, Wagner, Martins, Plateau, Weismann, and Dohrn, and in this country Haldeman, Leidy, Wyman, Clark, Cope, Hyatt, Walsh, Allen, W. H. Edwards, Dall, and the writer.

[2] This point is one which the writer has also made and published over twelve years ago in a communication to the Nation, holding that it is an important objection to the theory of natural selection, the very nature of which involves the existence of a world already stocked with life forms. What the theory of evolution should explain is the origin of these first ordinal and class forms. Given even a scanty fauna, isolated members of different orders and classes, and it is comparatively easy to account for the origin of the later more numerous descendants.

Finally, Mr. Spencer makes the following important admission:—

"This general conclusion brings with it the thought that the phrases employed in discussing organic evolution, though convenient and indeed needful, are liable to mislead us by veiling the actual agencies. That which really goes on in every organism is the working together of component parts in ways conducing to the continuance of their combined actions in presence of things and actions outside, some of which tend to subserve and others to destroy the combination. The matters and forces in these two groups are the sole causes properly so called. The words 'natural selection' do not express a cause in the physical sense. They express a mode of co-operation among causes, or rather, to speak strictly, they express an effect of this mode of co-operation" (p. 40).

Here we have frankly intimated what the Neolamarckian has for years insisted on, that the phrase "natural selection" is not a *vera causa*, but rather expresses the results or effects of the co-operation of a number of factors in organic evolution. In the case of too many naturalists the dogma or creed of natural selection has, it seems to us, tied their hands, obscured their vision, and prevented their seeking by observation and experiment to discover, so far as human intelligence can do so, the tangible, genuine, efficient factors of organic evolution.

EDITORS' TABLE.

EDITORS: E. D. COPE AND J. S. KINGSLEY.

The bringing into cultivation of the arid regions of the United States would increase the agricultural resources of the nation by one-third. The man who should devise a successful method of doing this would be one of the benefactors of his kind and country. The region to be thus reclaimed includes a wide strip extending north and south, east of the Rocky Mountains; a large part of the drainage basin of the Rio Grande; the hydrographic basin of the Great Colorado, and the Great Basin of Utah and Nevada. Small portions of all these regions are at present

rendered productive by irrigation, and give an earnest of the great possibilities which await the entire region. The productiveness of the Great Basin of Utah and Nevada would be equal to that of the most favored of temperate regions of the earth were water only accessible, as the results of irrigation by the Mormons and others have demonstrated.

The attempt to supply the lack of water by artesian wells has proven successful only in limited localities, and it has been long evident that some other source of supply must be looked for. Major J. W. Powell having given the subject his attention for many years, has at leached a solution as nearly adequate as the circumstances permit. He has proposed to Congress that the U. S. Government dam up the waters of the streams and rivers which issue from the various Rocky Mountain ranges, and thus accumulate their waters for a wholesale system of irrigation.

There appears to be nothing impracticable about this proposition. The manner in which the rivers issue from the Rocky Mountains in narrow canyons seems to be well adapted for the execution of such an enterprise. The artificial closing of the canyons of the Platte and Arkansas on the east, of the Rio Grande on the south, and of the Green and Gunnison on the west, would seem to present no great engineering difficulties, and immense bodies of water would be thus secured for purposes of irrigation. The benefits to agriculture resulting would be immense, and regions now almost useless to mankind, would become well populated. Some large regions would, however, not be reached by this system, especially a great part of the Great Basin.

Congress has appropriated $100,000 towards this important project, to be expended under the direction of Major Powell. We observe with pleasure that Major Powell regards this enterprise as entirely distinct from the U. S. Geological Survey. We hope he will continue to resist the attempt of some members of the lower House to saddle the expense of this undertaking on the Geological Survey; otherwise we will have another and gigantic illustration of a purely scientific enterprise swamped by the utilitarianism which is so rampant and all-absorbing in this country.

GENERAL NOTES.

GEOGRAPHY AND TRAVEL.[1]

ASIA.—Lieut. Younghusband's journey through Central Asia and over the Mustagh Pass.—Subsequent to his sojourn in Manchuria, in company with Messrs. Fulford and James, Lieut. Younghusband undertook, and successfully accomplished, an adventurous journey across Central Asia and thence into Hindostan by way of the Mustagh Pass, which had not previously been crossed by any European. His route from Pekin to Chinese Turkistan was the most direct and least frequented one, leading across the Gobi desert in a line lying between that traversed by Mr. Ney Elias, in 1872, and that followed by Marco Polo six centuries ago. As there is no silver coinage in China, the traveler set forth with some 60 lbs. of solid silver. The first place of importance reached was Kalgan, whence the caravans start for Kiakhta on the Russian frontier. Thence the valley of the Hoangho was ascended through a desolate loess country, where the villages were half in ruins, the roads were sunk thirty to forty feet below the surface of the soil, and horrible sandstorms were of almost daily occurrence in the spring. A hilly country, actually in Mongolia, but inhabited by Chinese, was then traversed for two days, when the traveler emerged upon the real steppes. The Great Wall, which is a magnificent affair near Pekin, has on the Mongolian frontier dwindled to a miserable mud wall not twenty feet high, with gaps in it often from a quarter to half a mile in width.

The Mongols, though a strong and hearty people, are said to have entirely lost their old warlike spirit, largely in consequence of the policy of the Chinese Government, which encourages the males to become Lamas. Sixty per cent. of the men are said to be now enrolled among these non-fighting celibates. Chinese immigrants are invading Mongolia as they have done Manchuria, and are taking to Mongolian habits sufficiently to, in some cases, fatten sheep for the Pekin market. At Kuei-hua-cheng, an important place of trade with Mongolia, camels were hired for the transit of the desert to Hami. After crossing the Galpin Gobi, Mr. Younghusband passed along the southern part of the Hurku Hills, crossing Prejevalsky's route at the Bortson well. For 190 miles the way lay over a plain lying between the Hurku range and a similar but rather lower range to the south of it. Near the end of the Hurku range, which here attains a height of about 8,000 feet, there is a

[1] Edited by W. N. Lockington, Philadelphia, Pa.

curious line of sand-hills attaining a height of 900 feet, and some forty miles in length, evidently formed by the wind driving the desert sand up into the hollow between the two rocky ranges. A depression of about eighty miles separates the Hurku range from the out-lying spurs of the Altai. The Altai range is here perfectly barren, the upper part formed of bare rock, while the lower is a continuous slope of débris. The cold winds of winter and the fierce sun of summer crumble the rocks, but the lack of rainfall causes the fragments to lie where they fall. After crossing the desert of Dzungaria, the Tian-Shan range was traversed at a height of 8,000 feet above the sea. The 1,255 miles between Kuei-hua-cheng and Hami were accomplished in seventy days. From Hami the party passed through Pichan, Turfan, Karashar, Kuchar, Aksu, and Ush Turfan, along the valley of the Aksu river, across the Belowti Pass (11,000 feet) and over the plain called the Syrt, to Kashgar, and thence to Yarkand. Here Lieut. Younghusband determined to attempt the Mustagh Pass, which is the shortest way into Kashmir, but has latterly fallen into disuse because of the raids of the Kanjut robbers. The Tupa Dawan Pass, a very easy one, 10,400 feet high, was crossed, and the valley of the Tisnaf, a tributary of the Yarkand, ascended. The next pass was that of Chiragh Saldi, after which the valley of the Yarkand was reached. This river here flows due west, but afterwards turns north to Yarkand.

On leaving Yarkand the party ascended the Surukwat stream to the Aghil Dawan range, which, after passing two more gorges, rose like a wall in front of them. Fortunately they struck the right path, and after some winding among the spurs, crossed the range through a great gap, over a long gravel slope. From a hill beyond the summit of this pass, standing at a height several hundred feet above the top of Mont Blanc, the great Karakoram or Mustagh range, forming the water-shed between the rivers that flow into the Indian Ocean and those of Central Asia, was visible as a succession of needle peaks like hundreds of Matterhorns, rising several thousands of feet higher still. Mr. Younghusband estimates the Aghil Dawan range at some sixteen to seventeen thousand feet. From it he descended to the Shaksgam river, hitherto unknown to geographers, though nearly equal in volume to the Yarkand, of which it is a tributary. Leaving this river, the Sarpo Laggo, a stream flowing from the glaciers of the Mustagh Pass, was ascended, and soon a full view was obtained of the second highest mountain in the world, then known only by the surveyors' designation of K2, but since named by Gen. J. T. Walker, Peak Godwen-Austen. At this point serious difficulties commenced. There are two Mustagh Passes. The new one, which had been found after the abandonment of the old pass on account of the accumulation of ice, was found to be impassible for the same reason, so an attempt was made

to cross by the old pass, leaving the ponies behind. Through deep soft snow, at a level of 19,000 feet, the travelers labored on till they reached the summit, whence no way of descent appeared save by crossing an icy slope to a cliff too precipitous for ice or snow to lodge upon it, and by descending this cliff to more icy slopes below it. By making a rope out of every available material, and by hewing steps, the descent was at last accomplished without serious accident, only to find themselves on an extensive glacier full of crevasses. At night they emerged upon a dry spot, but on the next day they crossed the great Baltoro Glacier, and it took two days more before they reached the village of Askoli. Supplies were sent back to the coolies with the ponies, and seven weeks later this part of the caravan reached Skardo by the Karakoram Pass route.

AFRICA.—BRITISH BASUTO LAND.—The August issue of the *Proceedings of the Royal Geographical Society* contains a map and an account of that part of Basuto Land that was saved to the Basuto in 1868. It is bounded by the Orange Free State, Natal, and Cape Colony. From the first of these it is divided for 130 miles by the Caledon river, and the country between this stream and the Drakensberg has been known to Europeans for some fifty years, while the larger section of the district, comprising the basin of the headwaters of the Orange river, has been little explored. The Drakensberg, which continues northward from Basuto Land into the Transvaal, appears to have originally been a sandstone plateau eight to ten thousand feet in height, the upper stratum of coarse friable rock sloping to the south and west, but falling away in perpendicular cliffs to the eastward. The range is now everywhere intersected by streams which have cut courses for themselves two to three thousand feet below the normal level of the mountains. A swamp about a mile across, at an elevation of 9,560 feet, gives rise to the Sengu, or principal source of the Orange River.

The last remnant of the Bushmen of this region were, in retaliation for repeated cattle thefts, destroyed by the grandsons of Moshesh, the consolidator of the Basuto tribe. Sir M. Clarke thus describes the cave Sehonghong, the home of the last Bushman chief, Soai: "It is a simple overhanging rock, the wall in the rear being covered with pictures of hunting scenes, war dances, predatory expeditions and various wild animals. Eland, hippopotamus, and the smaller buck are recognizable, while occasionally is depicted the uncouth form of the rain-god. In all the fighting pictures the Bushman is shown victorious. He is drawing the bow with tiny hands, or balancing himself on shapely feet, throwing the assagai. His foes, on the other hand, are exhibited with disproportionately big hands, fleeing on calfless legs stuck like broom-handles into the middle of their feet, and in the rear appear Bushwomen and boys driving herds of horses and cattle, the spoils of victory."

MR. J. THOMSON'S TRAVELS IN MOROCCO.—Mr. Joseph Thomson is now traveling in Morocco, where by cleverly-planned excursions he has entered the mountain fastnesses and done more than any previous traveler. From Demnat he made two interesting trips into the lower ranges, and visited some remarkable caves and ruins, as well as one of the most wonderful natural bridge-aqueducts in the world. He then made a dart across the main axis of the Atlas to the district of Tiluit in the basin of the Draa. As the tribes further west were in revolt, he was compelled to return to the northern plains. He then crossed the mountains by a pass a little south of Jebel Tizah, and reached the Gindafy safely. After a trip up a wonderful cañon, and the ascent of a mountain, whence the party were compelled to return, though by a new route, to their starting point. Mr. Thomson again crossed the mountains, and with no small difficulty and danger ascended the highest peak of the Atlas range north of Amsiviz, to a height of 12,500 feet. He then returned to Morocco, whence he wrote to the London *Times* on July 22. He proposes to make his way up the Urika river, and to work round to Mogador.

THE GERMAN EAST AFRICAN POSSESSIONS.—The *Mittheilungen* of the Vienna Geographical Society for June has an article by Dr. Hans Meyer on the German East African Protectorate, which is said to comprise the East African coastlands, terraces, and plateaus for a distance north and south of 550 miles, and east and west of 150 miles. The southern boundary is the Rovuma river, and a conventional line run from thence to Lake Nyassa, while to the north it is conterminous with the British Protectorate, from which it is separated by a line passing from Lake Victoria Nyanza in an oblique direction along the north foot of Kilima-njaro to the coast at about 5 S. Lat., below Mombasa. It thus includes the headwaters of streams flowing to the Nile, Congo, and Zambesi.

AMERICA.—SCHÖNER'S GLOBE OF 1523.—Messrs. Stevens and Sons, Great Russell street, London, have recently published a work which has considerable interest to all who study early American geography. Johann Schöner, Professor of Mathematics at Nuremberg in the early part of the sixteenth century, not only made a series of terrestrial globes, but left also a small pamphlet of four pages dated 1523, and thus later than the two first of his globes, which were dated 1515 and 1520. This pamphlet contains references to a globe on which were marked the discoveries of Magellan —discoveries that are not shown on Schöner's earlier globes. In 1885 Mr. Stevens found a fac-simile of this very globe in the catalogue of a Munich bookseller. The reproduction of Schöner's pamphlet and globe in fac-simile, with a translation and an intro-

ductory sketch of the early historical geography of America, together with a life of Schöner, and fac-similes of his earlier globes, constitute the present volume. In Schöner's globe of 1523 America is for the first time shown as a continent, instead of being broken up into many islands, as is the case in all earlier globes. Florida is for the first time named in print, the Moluccas have found their real place, as have many of the real isles of the sea, while all the monsters and bogus elements of American geography have disappeared.

FRENCH GUIANA.—M. Coudreau, who has recently returned to Cayenne, after a sojourn of eleven months in the western Tumac-Humac range, between the sources of the Itany and the Camopy, states that the country is a magnificent one, and the climate not bad. The party, having exhausted their provisions, lived out in the open air with the Indians, and led the same life with them. M. Coudreau became so popular with the Rucuyennes that he induced the *pamenchi* of the tribe and four of his men to accompany him to Cayenne, where their arrival caused a sensation, and where the Governor made them very welcome.

M. Coudreau has discovered the existence in undoubted French territory of sixteen new tribes of Indians, forming a group of 20,000 persons. These Indians are sedentary, and have attained a certain degree of civilization.

GEOGRAPHICAL NEWS.—The *Bolletino* of the Italian Geographical Society contains an account of the travels of Leonardo Fea in Tenasserim. The explorer ascended Mt. Mulai, the culminating point of the district (6,300 feet), after having followed the courses of the Jeeayngmyit and its great southern tributary, the Unduro. From Meetan the northward route to Tagata and Mulai passed through the little-known hilly country of the Ayaeen Karens.

M. Pavie, French Vice-Consul at Luang-Prabang, has succeeded in reaching Tonquin from that place by two routes, the more practicable of which seems to be that which passes to the northeast along the valley of the Namseng, a tributary of the Mekong, and then crosses the mountains forming the water-shed between the Mekong and Red River basins.

Baron H. von Schwerin recently gave an account to the Swedish Geographical Society of his expedition to the Congo region, where he explored the basin of the Inkissi, one of the tributaries of the Congo, and made from Banabna an excursion southward into the country of the Mushirongi, never before visited by a European. He also made a trip into the lands of Kakondo and Kabinda, north of the Congo mouth.

The population of the Caucasus, which in 1858 was only 4,526,000, had in 1880 risen to 5,870,000, the immigration of Cossacks and Russian peasants more than counterbalancing the emigration, while all districts have a regular excess of births over deaths. The Russian element is now in excess of any other, consisting of 1,410,000, while the Georgians are but 1,150,000 in number, and the Lesghiens and mountaineers have diminished since 1858 from 1,400,000 to 1,050,000.

Lukoma, the principal island in Lake Nyassa, though only four and a half miles long and two and a half wide, contains 2,500 inhabitants. Ula, or witchcraft, of the kind described with much graphic force by Mr. Rider Haggard in one of his earlier works, prevails and is a great curse in the island.

Herr Aug. Fitzau (*Deutsche Geographische Blatter*) gives an account of the West African seaboard between Morocco and the Senegal. Though Arabic is the prevalent language, he believes that the old Hamitic or Berber is still the chief ethnic element. The writer describes in detail the coast between Agadir and St. Louis.

Count Teleki has ascended Mt. Kenia to a height of 15,000 feet, and believes its elevation to be greater than that of Kilima-njaro. Corrections made by Dr. H. Heyer himself in the barometrical observations taken during his ascent of Kilima-njaro prove that he did not reach within 820 feet of the summit of the mountain.

Petermann's *Mitteilungen* (Part 5) gives an account of a partial exploration of the small and little-known group of the Nanusa Islands, seven in number, and situated in 4.35 N. Lat., and 127.5 E. Long. Only three of the islets—Karaton, Mengampit, and Onrata—are inhabited, and the total population is about 1,000. All the islands are girt by reefs, and the only good anchorage is on the east side of Karaton. Mengampit has a hill, 800 feet high, in its centre, and is well wooded, but Karaton is flat.

GEOLOGY AND PALÆONTOLOGY.

THE EXTINCT SCLERODERMS.—By reason of the deviation from copy of the note on "Some Extinct Scleroderms" in the AMERICAN NATURALIST for May, 1888, p. 448, it might be inferred that there were more extinct genera of Balistids than are really known. The genera are (1) *Balistomorphus* Gill (=*Acanthoderma* Ag. 1843, not Cantraine 1835) and (2) *Bucklandium* Koenig (=*Glyptocephalus* Ag. 1843, *fide* Pictet, not Gottsche 1835).

The part of Professor Zittel's valuable "Handbuch der Palæontologie" (III. Band, 2. Lief.) describing the Teleost fishes, has recently appeared. The correlation between the morphology and systematic relations of existing and extinct fishes has been obscured and sometimes contradicted by the adoption of the very misleading and unscientific classification of Günther. The anachronistic idea that there is near relationship between Plectognath and Ganoid, fishes is consequently likewise still adhered to.[1] This idea has been so thoroughly exploded by several writers and its fundamental error is so obvious to any one who considers the evidence and compares the structural characteristics of the various types, that surprise must be felt that so intelligent a palæontologist as Professor Zittel clings to it. There can be little, if any, doubt to any competent observer who compares the skeletons and other parts of Scleroderm fishes with the Teuthidids and Siganids that the views of Dareste, Cope and others are correct, that the Scleroderms have originated from the same stock as the Teuthidids, and that consequently they are removed further than most fishes, and further even than the related Teuthidoidea, from the Ganoids. The genus *Protobalistum* is adopted by Professor Zittel with the expanded limits recently assigned to it by Baron de Zigno. To those who adopt Dr. Günther's views of the classificatory value of characters, the demonstration of the erroneous association of the forms embraced under the genus is easy. The relative size of the spinous and soft portions of the dorsal furniture are regarded by Dr. Günther as of *more than family* value, as in the case of his *Acanthopterygii perciformes, A. cotto-scombriformes, and A. blenniiformes.* Now, just such differences as have been used to separate those groups are found between the two fishes referred to the genus *Protobalistum* by Baron de Zigno and Professor Zittel. The *P. imperiale* has the spinous dorsal *much longer* than the soft, while the *P. Omboni* has the spinous dorsal *much shorter* than the soft. Therefore the differentiation of the two species not only generically but as family types follows. It is not even certain that the typical *Protobalistum* is a true Scleroderm.

The diagnostic characters of the several families of Scleroderms are as follows:—

PROTOBALISTIDÆ.—Scleroderms[2] with the spinous dorsal very elongated and composed mostly of long spines separated by consid-

[1] "Diese.....Fische zeichnen sich besonders durch ihre eigenthümliche, bald aus harten rhomboidischen Schuppen, bald aus knöchernen Schildern, Stacheln oder Platten bestehende Hautbedeckung, sowie durch die innige Verwachsung der meisten Kopfknochen aus. Agassiz rechnete sie noch zu den Ganoiden, mit denen sie in der That mancherlei Uebereinstimmung aufweisen." Zittel, op. cit., p. 257.

[2] It is possible that the Protobalistids may prove to be not Scleroderms but Acanthopterygians.

erable intervals, the soft dorsal short, and with ventrals atrophied or represented by weak spines.[1]

TRIACANTHIDÆ.—Scleroderms with the spinous dorsal very short and composed of a stout anterior spine and several approximated weak ones behind it, the soft dorsal oblong, and with ventrals represented by stout spines, and with or without weak axillar rays.

BALISTIDÆ.—Scleroderms with the spinous dorsal very short, being represented (1) by a stout spine with which a weaker posterior spine interlocks in erection (and often a third spine exists), or (2) by only a single slender spine; the soft dorsal long or oblong, and the ventrals wanting.

These characters are supplemented by important osteological ones for the last two at least.

The family Triacanthidæ was represented in the eocene seas of Europe by the genera *Acanthopleurus* (Ag.) and *Protacanthodes* (Gill). The affinity of the former to *Triacanthus* was remarked as long ago as 1859 by von Rath (*Zeitschr. deutsch. Geol. Ges.*, V. ii., pp. 130–132).

Other genera referred to the sub-order of Scleroderms (*e.g.*, *Blochius*, *Dercetis*, *Styracodus*, *Chilodus*, *Cœlorhynchus*, *Ancistrodon*) are quite remote from it.—*Theo. Gill.*

SECOND NOTE UPON ROMANOVSKY'S MATERIALEN ZUR GEOLOGIE VON TURKESTAN.—In the Tertiary, as in the Cretaceous, the absence of fossils renders it almost impossible to mark off stages, and even precludes the exact determination of the base of the group. It would appear that the continuity is complete, and that Eocene, Oligocene, Miocene, and Pliocene are all represented. The Nummilitic has been met with only upon the borders of the Aral Sea, where it is overlaid by the sandstones, clays, and limestones belonging to the Oligocene, which are surmounted by the Miocene limestones, and by the argillaceous beds of the Sarmatic stage; these last form the upper layer of the plateau of Ust-Urt. Conglomerates, which form heavy beds in the mountains, are gradually replaced by rocks of finer grain as the distance from their feet increases. The Cretaceous strata of Turkestan contain important beds of phosphorite (mouth of the Syr-Daria), of gypsum (Tian-shan, Pamir), petroleum (Fergana), and sulphur (basin of the Amou-Daria); and the Tertiary has intercalations of salt and gypsum (Sangar, Samarcand), the thickness of which diminishes gradually towards the west.

The history of Turan during the recent geological periods has many features in common with that of the rest of Central Asia, and especially with that of Afghanistan. After the continental

[1] See de Zigno, p. 4; Am. Nat., 1888, p. 447, note.

phase of the Jurassic, came the marine invasion corresponding to the deposition of the Cretaceous beds; sedimentation then continued quietly and tranquilly during the Tertiary period, at the bottom of a sea at first open to a large extent and communicating freely with the ocean, but the area of which was always diminishing, until in the Sarmatian epoch this Mediterranean became closed, and was gradually converted by evaporation into distinct sheets of water, the remnants of which still remain and diminish under our own observation. During these ages the great mountain border of the East gained in height and in development. The Pliocene is at its summit intimately connected with the Aralo-Caspian deposits, which are chiefly composed of the debris of the Cretaceous and Tertiary strata, the slight cohesion of the older deposits facilitating greatly the disintegration effected by atmospheric agencies. The Aralo-Caspian fossils belong to species that now inhabit the Caspian and Aral Seas, and their nature and mode of distribution is such that, taken in conjunction with what is known of the existing Caspian fauna, it is possible to ascertain the exact circumstances in which the sediments were laid down; since all the species except *Cardium edule* and *Lithoglyphus caspius* live near the coast, at depths never exceeding fifteen metres. The Aralo-Caspian Sea consisted of two immense basins, the western corresponding to the Caspian, though immensely more extensive than its existing shrunken remainder; while the eastern comprised the Aral, but extended far beyond it (according to Ssevertsoff it reached Lake Balkash). The western sea was much the larger and more profound, and the eastern was strewn with scattered islands. Between these basins the plateau of Ust-Urt formed a long peninsula, and the basins communicated by a sinuous strait passing through Lake Sarykamish. The part of this strait leading from the Caspian to Sarykamish is the present Usboi, and, though considered by Grimm as an ancient bed of the Oxus or Amou-Daria, can never have been such, as its bed contains no traces of alluvium, but consists of Aralo-Caspian deposits. The facts indicate that in the Aralo-Caspian epoch the Oxus, taking in the Khiva region the course of the present Urun-Daria, fed Lake Sarykamish, which rapidly dried up when the river turned aside to the benefit of the Aral. The winds from the north and northeast have transformed into deserts the dry beds of the ancient lakes, and have formed those long ranges of dunes called *Barkhans* that cover such vast spaces throughout Turkestan.

RÜTIMEYER ON THE CLASSIFICATION OF MAMMALIA, AND ON AMERICAN TYPES RECENTLY FOUND IN SWITZERLAND.[1]—

[1] Ueber einige Beziehungen zwischen den Saügethierstämmen alter u. neuer Welt. Erster Nachtrag zu der Eocenen Fauna der Egerkingen; von L. Rütimeyer; Zurich, 1888. Abhandl d. Schwiez. Palæontol. Gesselsch. Bd. XV.

This important memoir is divided into two portions as indicated in the above title. I refer to the second part first in order, by recording the discoveries it announces. Prof. Rütimeyer has made the highly interesting discovery of a species of Phenacodus at Egerkingen, which he names *P. europæus*. He also refers species from the same locality to the genera Protogonia, (?) Mioclænus, and (?) Pelycodus, and to the new genus Meniscodon. Unfortunately all of these species are known from the teeth only, so that the references are not yet final. He also gives descriptions of new specimens of *Cænopithecus lemuroides* Rütim. and *Proviverra typica* Rütim.

In the first part of the memoir, Prof. Rütimeyer discusses the relations of the various members of the Ungulata, with reference to their classification. This consists chiefly of a criticism of the system proposed by Cope, and the results he reaches are expressed as follows: (p. 62).

First.—That the categories of Ungulata, based by Cope on the nature of the mutual carpal and tarsal articulations, do not furnish exact definitions for systematic use. Although they furnish instructive series of modifications of the mechanism of motion, they do not offer sharp lines of distinction. Especially can the so-called condylarthrie have a very relative value, and between it and the diplarthrie is there no sharp line.

Second.—The plan of structure which characterizes the superior molars of the Condylarthra consists in a disposition of the tubercles, to which he applies the name trigonodontie, since there are three principal tubercles arranged *en triangle*, two external and one internal, so that the cross-valley of the crown is closed within. It is this type of dentition which is common among lemurs and Insectivora, and which prevails among Carnivora. It is thus probable that trigonodontie is to be regarded as an earlier and more primitive form of molar than those of the zygodont (quadritubercular) type. The selenodont type appears to have arisen from trigonodont ancestors.

Third.—The trigonodont structure of superior molars as is present in the Condylarthra is by no means confined to American Ungulata, but is found in Europe even to generic details; so that it is probable that the foot-structure of the Condylarthra will be also found in Europe.

Fourth.—It is therefore not necessary to look to America alone for the first known ancestors of the horse.

Fifth.—Except the Dinocerata, which, like the Toxodontia, has a limited range in America, the types of Mammalia have developed in such complete parallelism that we are compelled to look to a common and extensive geographical source for them.

Sixth.—Among the false-lemurs, the Cænopithecus of Egerkingen

appears to be as nearly allied to the North American Mesodonta as to the European Adapis.

I propose to offer some observations on these propositions, especially to the first and second. The third, and those following, relating as they do to the important discoveries of Prof. Rütimeyer at Egerkingen, constitute valuable additions to the sciences of palæontology and mammalian phylogeny.

The first proposition, that the characters of the carpus and tarsus on which I have relied for discrimination of the orders of Ungulata are insufficient for that purpose, is probably so far true, as a similar asser tion made with regard to all structural characters whatever would be. With the discovery of new forms, and the completion of phylogenetic lines, the sharp demarcations we now employ as definitions will vanish. But I claim with regard to the case of the Condylarthra, *that such discoveries have not been yet made*, and that Prof. Rütimeyer's views on this point have been reached by reason of several misconceptions on his part. The supposition that the tarsus of Phenacodus (p. 14) resembles in any degree that of the rhinoceros and tapir, is an unaccountable error. Also (l. c.) the supposition that the carpus of those animals does not represent the diplarthrous type is an equally extraordinary misconception. So is (p. 15) the opinion that such small contact of the astragalus with the cuboid bone as exists in Phenacodus and Hyrax is diplarthrism comparable to that of *Hyracotherium venticolum*.

But supposing Prof. Rütimeyer's view that the carpus of Phenacodus is proboscidian, and the tarsus rhinocerotic, to be correct, an order distinct from Proboscidia and Perissodactyla would be indicated.

The fact is that Prof. Rütimeyer, probably from want of specimens of Condylarthra, has not fully grasped the meaning of the taxeopod, and especially the Condylarthrous type of carpus and tarsus. That type is the unguiculate and carnivorous, accompanying hoof-shaped ungues, and as yet *no transitions* to the usual ungulate type have been found *within the Ungulata*, except in the carpus of the Anthropomorpha (and the result is not typically ungulate). The Condylarthrous carpus and tarsus are also *lemurine*, and are well distinguished from other ungulate types. The structure of the astragalus of Dissacus among the Unguiculates shows us what the transition will be like when it is found.[1]

The second proposition ascribes what Prof. Rütimeyer calls trigonodontie as a definitive and general character of the Condylarthra. I must here record an objection to the introduction of the word trigonodont. It is proposed to replace the term tritubercular among the Ungulata, so that the latter phrase shall apply only to the Unguiculata. But there is absolutely no difference between

[1] Transactions Amer. Philosophical Society, 1888, pp. 343–4.

this type of tooth in the two divisions of Mammalia, and by introducing a new word we obscure this important identity, as well as encumber our memory and literature. The introduction of unnecessary terms has been long a vice in science, but it is now reaching such proportions that specialists must agree to protest against it. Tritubercular and trituberculy or trituberculie are certainly sufficient for all practical purposes.

As regards the use of this character as definitive of the Condylarthra, there is no doubt of its prevalence, and that traces of it can be found in the quadritubercular molars of many Phenacodontidæ. It is hard, however, to see it in *Protogonia puercensis*,[3] and is so little pronounced in various species as to make it, like many other characters that are important when fully developed of little more than individual value. As regards the phylogenetic significance of the tritubercular molar, I of course agree with Dr. Rütimeyer's indication, having already expressed the same in various publications, but first in 1884.[1] Of this priority, Dr. Rütimeyer is probably not aware.

I must here correct two misquotations of my writings which have slipped into Dr. Rütimeyer's text, both on p. 12. First, that I have regarded diplarthrism of the astragalus as a primitive character. I have, on the contrary, always regarded it as a high specialization, and have so stated many times in print, and never otherwise. Second, that having placed Hyrax in the Taxeopoda on one page, changed my view on a subsequent page. (Tert. Vert. III, p. 382). This is also a misconception; reference to the page cited shows no such change, nor has any such change of opinion ever been made by me.

Dr. Rütimeyer refers to his early paper on the Odontographie der Hufthiere, published in Basel in 1863.[3] I must now confess my own shortcoming in not having long ago studied this important memoir. In this study of the structure of the molar teeth of the Ungulata Prof. Rütimeyer *anticipates by ten years the same results reached by Kowelevsky and myself in 1873.* For the first determination of these homologies *exclusive credit is due to Prof. Rütimeyer.* He divides the molar teeth of Mammalia into three categories, the simply conic "Homœodont;" the vertically plicate, "Elasmodont;" and the cross-crested by junction of four tubercles, the "Zygodont." To the homœodont I subsequently gave the name hoplodont, which name must be suppressed. So also with my term ptychodont, which must give way to the prior elasmodont. As to zygodont, I prefer to recognize two types of molar crown in this series instead

[1] Transac. Amer. Philos. Society, p. 352, fig. 12.
[2] American Naturalist, 1883 (April), p. 407, and Proceedings American Philosophical Society, 1873-4, p. 324.
[3] Verhandl S. Naturforsch. Gesselsch Basel II, 1863, p. 558.

of but one, viz.: a simply quadritubercular, and a specialization of it where the tubercles are connected together by crests. For the former I used Kowelevsky's term bunodont, and to the second I gave the name lophodont. I find the zygodont idea too comprehensive, and also too restricted as applying only to cross-crests, while longitudinal crests (as in Rhinoceros) are embraced in my idea and corresponding term of lophodont.

Prof. Rütimeyer also ascertained that the remaining internal cusp of the tritubercular superior molar is the anterior internal.

It is difficult to ascertain from Prof. Rütimeyer's memoir to what extent he translated his homological determinations into phylogenetic equivalents. His language allows us to suppose for instance that in Ungulata, bunodont molars are derivatives from lophodont types, and simple premolars from the complex; but it is not certain that he wishes us to regard him as holding such an opinion. The histories of the tritubercular and tuberculosectorial and triconodont molars and the resulting phylogenetic deductions, are not embraced in this memoir.—*E. D. Cope.*

Geological News.—General.—Two recent works of M. A. Daubree, the one upon subterranean waters in the present epoch, and their composition from the point of view of the part they play in the earth's crust; the other upon the *rôle* of subterraneous waters in ancient epochs, are worthy of attention from all who are interested in rock-formation. A lengthy review of both will be found in the *Neues Jahrbuch für Mineralogie, Geologie, und Palæontologie*, II, Band, Zweites Heft., 1888.

Petermann's *Geographische Mitteilungen*, XXXIII., 1887, contains a geological map of Africa upon a small scale, accompanying an article by Dr. Gûrich. The sketch is colored to show six formations, but a large portion of the continent is, as might be supposed, left uncolored. The crystalline rocks, including the Silurian clays, predominate on the southeastern, southwestern, Red Sea, and Guinea coast districts; the Palæozoic, which as colored includes the Dyas in the Atlas Mountains, but excludes that formation elsewhere, is prominent only in patches of the Sahara, and in South Africa; the Karroo-formation, which in the south includes Dyas and Trias, covers all South Africa save the portions occupied by the crystalline and palæozoic rocks, and reappears in large patches on the eastern and western coasts, as well as in the Niger region; the Cretaceous is most conspicuous in the north, where it occupies the greater part of the Barbary States west of Barca; and the Tertiary strata cover the entire lower Nile valley, and stretch along the Mediterranean west to the Gulf of Sydra. From the head of the eocene to Khartum cretaceous rocks are shown bordering the Nile. The principal mass of the younger

eruptive rocks is in Abyssinia, where they are of early tertiary date.

The author gives the following summary. The African continent falls into three distinct geological regions: (1) The Atlas, which comprises a tolerably complete series of formations, that collectively have undergone similar disturbances to those that have taken place in the Alps; geologically, this region belongs to Europe. (2) The Desert region is distinguished by the horizontality of the Palæozoic strata and by great gaps below the chalk; the latter formations show a development corresponding to that of Syria and Arabia. (3) The South African region, which consists of a boss of crystalline mountains of enormous extent, covered with innumerable layers of horizontal sandstone, the age of which lies between that of the Carboniferous and that of the Jura. Analogous conditions occur in India. The marginal zone of later formations is also characteristic.

I. C. Russell contributes to the August issue of the *Geological Magazine* a summary of what is known of the geological history of the Jordan-Arabah depression, which offers so many points of resemblance to the Great Basin of North America that he ventures some suggestions and hypotheses.

DEVONIAN.—Numerous crinoids collected in the Lower Devonian strata of Bundenbach and Gemunden are described by Dr. O. Follman in the *Verh. d. nat. Jahrg.*, xxxiv. 5 Folge, IV. Bd., pp. 113–138. Seven new species are described and figured.

CRETACEOUS.—Nœtling distinguishes three groups of strata in the cretaceous of Syria and Palestine. The uppermost contains Gryphæas and Cephalopoda, but is without Nerinea and Rudista. The upper part consists of chalk with flints, the lower of bituminous shales and lime, and the group corresponds to the Senonian. The middle group corresponds to the upper Turonian, and contains numerous Rudista, Cephalopoda, and Nerinea, but no Trigonias or Cythereas; it consists of dazzling white thick limestones with alternating beds of gray clays, but contains no flints. The lowest group has many Trigonias, Cythereas, and Nerineas, but few Cephalopoda and Rudista; it consists of sandstones, clays, and arenaceous limestones, and is identified with the lower Turonian. The Syrian cretaceous is distinguished from that of Europe by the absence of Belemnites and Inocerami. The Trigonia sandstone of the lowest group has a European character, while the Senonian resembles that of Africa.

CÆNOZOIC.—According to M. Gaudry, the following are the heights of the largest fossil mammals that have yet been discovered:

(1) The *Dinotherium giganteum* from the upper miocene of Attica, the tibia of which, brought from Pikermi by M. Gaudry, measures 0.94m. in length, representing a height of 4.43m. at the shoulders, and 4.96m. at the top of the head. (2) The *Elephas antiquus*, found in the quaternary near Paris, height at the withers 3.95, and to the summit of the head 4.42m. (3) The *Elephas meridionalis* from the pliocene of Durfort, which is the largest entire mammalian skeleton (fossil) yet known, and is now at the Palæontological Museum in the Jardin des Plantes; its height at the shoulders is 3.77m., and it measures 4.42m. to the top of the head. (4) The *Mastodon americanus* from the quaternary of the United States measures 3.55m. to the top of the head. (5) The *Elephas primigenius*, or mammoth of the Siberian quaternary, is 3.42m. to the top of the head.

MINERALOGY AND PETROGRAPHY.[1]

Petrographical News.—In a late number of the *American Geologist*,[2] Messrs. Herrick, Clarke and Deming have a short article on some American norites and gabbros. Three rocks are described. The first is from Marshall Co., N. C., and is called olivine-norite. Its feldspathic constituent is labradorite, and its pyroxene is regarded as bronzite. The second—a porphyritic diorite, contains garnet and apatite. It is a facies of the norite. The Duluth gabbros are finally taken up and briefly described. In one phase of this rock the authors think they have found feldspar crystals, with a central core of labradorite, surrounded by a zone of orthoclase. Very little new is stated in regard to these rocks, except the view that the orthoclase-gabbros may be derived by the action of solutions (emanating from acid rocks) upon olivine-gabbro. The paper contains the statements of many important views, which, however, will not generally be accepted by petrographers unless substantiated by many more facts than the authors have been able to discover.—An instructive paper on some English tachylites is that by Mr. Cole in the *Quarterly Journal of the Geological Society*.[3] In it he describes a glassy basalt which exhibits all the stages in the transition from a glassy to the completely spherulitic forms so familiar among acid lavas. The spherulites are sometimes composed of an intergrowth of gray and brown fibres, which show the

[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Maine.
[2] June, 1888, p. 339.
[3] May, 1888, p. 300.

strongest absorption in reversed position, the brown fibres becoming darker when their long axes are parallel to the short axes of the nicols, and the gray fibres when their transverse axes are parallel to this direction. As the result of his observations, Cole is inclined to regard variolite as a perlitic tachylite, whose perlitic cracks have been filled with secondary minerals.—Chelius[1] divides the dyke rocks cutting the eastern and the western areas of crystalline schists in Spessart and Odenwald as granite-porphyries and minettes in the latter area, and kersantites in the former. The kersantites are panidiomorphic aggregates of plagioclase and augite, together with hornblende, mica, quartz, apatite and a few rare minerals. The panidiomorphic structure passes into the holocrystalline porphyritic toward the edges of the dykes. The minettes of the Odenwald fall into two groups, the minettes proper, and the vogesites or minettes poor in mica. The latter embrace both augitic and hornblendic varieties. The minettes sometimes contain augite and sometimes biotite as their principal ingredient. The granite porphyries possess no peculiarity of structure or composition to which attention need be called.—The article on the Archæan Geology of Missouri, to a preliminary notice of which attention was directed in these pages a short time ago, has lately made its appearance.[2] In addition to the interesting observations already noted, it may be remarked that Mr. Haworth finds the nature of the plagioclase in the porphyrites from this region to be in no way connected with the presence or absence of quartz in the rocks. A more basic feldspar is sometimes found in a porphyrite containing free quartz, than in one in which no quartz is visible. The ground mass of a certain class of the porphyries resembles in structure the appearance known as pœcilitic. This is due to the inclusion of small particles of feldspar in quartz.—The elæolite-syenite[3] from the middle Transvaal, South Africa, consists of apatite, sphene, augite, hornblende, nepheline, feldspar, sodalite and zeolites in the order of their age. The porphyritic feldspar, probably anorthite, contains inclusions of all the older constituents. The augite occurs in two generations. The larger crystals have the optical properties of common augite, and contain a small percentage of alkalies. The mineral of the second generation is grouped into little bundles, and has the properties of acmite. It contains both alkalies and manganese. The nepheline is for the most part fresh; but in some cases has undergone alteration into zeolites.—A typical chlorite-schist has been discovered by Cathrein[4] at Gerlos, in the Tyrol. In a muscovite-quartz

[1] Neues Jahrb. f. Min., etc., 1888, ii., p. 67.
[2] Inaug. Disser., Johns Hopkins Univ., 1888, and Amer. Geologist, May and June, 1888.
[3] E. A. Wülfing. Neues Jahrb. f. Miner., 1888, ii., p. 16.
[4] Verh. d. k. k. Geol. Reichsanst.

background are porphyritic chlorite crystals with all the characteristics of chloritoid. Graphite, ankerite, zircon, tourmaline and rutile are the prominent accessory constituents. The rutile occurs as needles penetrating all the other minerals.—In an article on the bituminous rocks of Nullaberg, in Sweden, Törnebohm[1] gives the results of his examination of the bituminous matter existing in the archæan schists of that region. The locality has been known for some time, and is quite noted as having afforded data for arguments in favor of the existence of life in the globe during archæan time. The rock in which the organic matter occurs is a schist composed of microcline, chlorite, a little garnet and other accessory components. It is interstratified with gneiss, and is about fifteen metres in thickness. A part of the organic matter is in little lumps and irregularly shaped pieces, which are thought by the author to be original. It is sometimes entirely surrounded by microcline. Other bituminous substances fill cracks and cavities, which were probably produced in the rock by dynamic forces. This is younger in age than the rock itself, and was probably produced by the saturation of shattered rock by liquid hydrocarbons, which afterwards dried out, leaving a deposit of asphaltum.

Miscellaneous.—In connection with the article of Törnebohm, referred to above, it may be of interest to call attention to a recent article by Engler,[2] on the origin of petroleum. The experimental work of this chemist substantially re-enforces the theory which supposes petroleum to be the result of the distillation of the remains of marine animals at a low temperature and under pressure. Engler has obtained a series of oils, very similar in composition to the most prominent hydrocarbons of petroleum, by the destructive distillation of menhaden under a pressure of ten atmospheres, and at a temperature of 320°–400°.

ZOOLOGY.

Zoological News.—Porifera.—Vol. XXV. of the Challenger Reports is entirely devoted to the Tetractinellidæ, which are illustrated by forty-four plates. Professor Sollas classifies the Porifera as follows: Class (1) Megamastictora, containing the single sub-class Calcarea; and Class (2) Micromastictora, including

[1] Neues Jahrb. f. Min., etc., 1888, ii., p. 1.
[2] Ber. d. d. Chem. Gesell., 1888, p. 1816.

the three sub-classes Myxospongiæ, Hexactinellidæ, and Demospongiæ. The Demospongiæ he sub-divides into Tetractinellida and Monaxonida, the former comprising such Demospongiæ as have some or all of the scleres in the form of tetraxons, triænes, or desmas.

Cœlenterata.—The third of the reports composing Vol. XXIII. of the Challenger series is by Professor G. J. Allman, and forms the second part of his memoir of the Hydroida. Only three genera of Gymnoblastic hydroids: Stylactis, Eudendrium, and Monocaulos are represented in the Challenger collections. *M. imperator* is a most remarkable hydroid, having a stem seven feet long though but half an inch thick, and a stretch from tip to tip of tentacles of nine inches, so that all other hydroids sink into insignificance as regards size when compared with it. It was obtained at the depth of four miles beneath the surface. The Calyptoblastea were well represented in the collection. Idia, Lamoureux, proved on thorough examination to be constructed on a quite unique type, and a new genus, Perisiphonia, represented by two species, was discovered. In this genus the axial tube which bears the hydrothecæ is surrounded by numerous tubes set with tubular sarcothecæ, and the hydrothecæ projects through interstices in these axial tubes. The curious genus Synthecium is enriched with two new species, Thecocladium with one.

Professor Allman's system of classification does not allow those Hydromedusæ which have not yet been traced back to hydriform stocks, but which, from their resemblance to those that have been so traced, may be presumed to have been budded off from fixed trophosomes, to compose a separate group, but leaves them to find their right place in the future. His sub-orders are, therefore, (1) Gymnoblastea, in which the hydranths and gonophores are always naked, and in which the latter may be hedrioblasts or planoblasts, and the planoblasts are almost always Anthomedusæ, *i.e.*, have the generative elements developed in the walls of the manubrium. (2) Calyptoblastea, which have hydrothecæ and gonangia, and, when they produce planoblasts, have them in the form of Leptomedusæ, *i.e.*, with the generative elements developed along the line of the radial canals. (3) Eleuthero blastea, including the Hydra, with hydranth buds which become free. (4) Hydrocorallia, with a calcareous corallum permeated by cœnosarcal tubes from which the hydranths are developed. (5) Monopsea, including forms that are known to be developed directly from the egg. (6) Rhabdophora or Graptolites.

Vermes.—Vol. XXIII. of the Challenger series has a short report upon the Entozoa of the collection, by Dr. O. von Linstow.

Only sixteen species are described, ten of which are Nematodes and six Cestodes. The species obtained were chiefly from the alimentary tract of birds, and include four new forms of Ascaris, three of Filaria, one of Prothelmius, four of Tænia, and two of Tetrabothrium. The appendix mentions a large larval Echinorhynchus found in the abdomen of a Euphausia, two Distoma, and a Gordius found in a crab, so that the other groups of Helminths are not entirely absent from the collection.

Mollusca.—The report upon the Heteropoda of the Challenger collection, by E. A. Smith, although short, contains a most complete synonymic list of all known forms of the group. It is the fifth report in Vol. XXIII.

The first two memoirs of Vol. XXIII. of the Challenger Reports are by Dr. Paul Pelseneer, and treat of the Pteropoda Thecosomata, the Gymnosomata having been previously dealt with in Vol. XIX. The Thecosomata have a less highly organized alimentary canal than the Gymnosomata, and content themselves with humbler prey, feeding chiefly on Radiolaria, Foraminifera, Infusoria, and even on some of the lower Algæ. Specimens of the group were taken alive at seventy different stations, but no undescribed species were found. All the generic titles that have been given may be reduced to eight, viz.: Limacina, Peraclis, Clio, Cuvierina, Cavolinia, Cymbulia, Cymbuliopsis, gen. nov. and Gleba. The third part of the report treats of the anatomy of the Pteropoda generally. He considers the group, not as a class, but as a recent and specialized variation from the Gastropod type. He places them among the Pectinibranchiate Oplsthobranchs, and traces the Thecosomata to the Bulloidea, and the Gymnosomata to the Aplysioidea.

Crustacea.—Vol. XXIV. of the Challenger Reports is occupied with the report of C. Spence Bate, F.R.S., on the Crustacea Macrura. Though styled one volume, it is in fact two goodly tomes, the one containing 1030 pages of text, the other 157 lithographic plates. Not only are generic and specific diagnoses given with minuteness, but all that is known of the developmental stages (in which direction there is still much work to be done) is reproduced. Bate follows Dana in placing the Penæidea in a separate division, which he names Dendrobranchiata, and he considers the Schizopoda or Stomapoda as forming an aberrant branch of the Dendrobranchiata, more nearly allied to the degraded forms of the Penæidea than to those of any other group. He asserts that, "with the exception of the pereiopoda, the several genera do not possess a single character that is not held in common with some genus of the Macrura," divides the Macrura into the two principal

divisions of Trichobranchiata and Phyllobranchiata, with the Dendrobranchiata (Penæidea and Sergestidæ), intercalated. Each of these divisions is divided into two sections, the Normalia and the Aberrantia. The family Galethæidæ belongs among the Trichobranchiata Aberrantia, while the rest of the old group Anomoura form the Aberrantia of the Phyllobranchiate section. These groups will form the subject of a report by Professor John R. Henderson.

Recent works upon lacustrine faunas have shown that copepods, and especially those of the genus Diaptomus, are both more numerous in species and more widely distributed than is generally supposed. Most of the ordinary types have been confounded under the name of *Diaptomus castor*, so that until now it has not been possible to speak with any approach to certainty of the geographical distribution of any species. M.M. de Guerne and Richard have now, thanks to the numerous documents they have studied on the subject, given a map of the distribution of Diaptomus, and proved that it may be regarded as a cosmopolitan genus.

ENTOMOLOGY.[1]

ENTOMOLOGY FOR BEGINNERS.—The most important Entomological event of the past month is the appearance of an elementary text-book by Dr. Packard.[2] The following review of this work has been prepared by a prominent Entomologist at our request.—*J. H. C.*

Dr. Packard's Entomology for Beginners fills a niche which has long been vacant, and supplies a need which has been so pressing, particularly of late years, that it will be and should be warmly welcomed; and wherever imperfections may be noticed by the critical reader, these should not make him forget that Dr. Packard has, in writing this book, given us really the first treatise of its class in the English language. We find after careful reading that an astonishing amount of information has been crowded into its three hundred odd pages, and that the plan of the work is on the whole satisfactory. The author has in his preface outlined his ideas as to the probable usefulness of the work with sufficient

[1] This Department is edited by Prof. J. H. Comstock, Cornell University, Ithaca, N. Y., to whom communications, books for notice, etc., should be sent.

[2] Entomology for Beginners, by Dr. A. S. Packard, M.D., Ph.D., New York. Henry Holt & Co. 1888.

modesty, and, placing ourselves in the attitude of the first two classes of his probable readers, namely the beginners and the amateurs or dilettante entomologists, we find that we have little of which to complain. The first class of readers, however, whom he hopes to reach, the farmer, the fruit-grower, and the gardener, the book will hardly satisfy as a hand-book. No one, however, can write a book on this subject for farmers unless he is a farmer himself.

While our first impression was that Dr. Packard had made a mistake in adopting in this elementary work the division of the class into sixteen orders, our maturer opinion coincides with his own judgment. Brauer's classification, or some slight modification of it, is bound to be generally adopted. The sooner this is brought about the better, and in no way could a ready adoption be more speedily achieved than by teaching the system to younger entomologists, and to beginners in the study. Dr. Packard's substitution of *Plectoptera* and *Mecaptera* for *Ephemeridæ* and *Panorpatæ* is, of course, done in the interest of uniformity, but we regret his apparent slip in the etymology of his word *Mecaptera*. This leads us naturally to criticise the glossary, in that for less than half of the words defined is the derivation given. The same incompleteness is seen in the acknowledgments of illustrations. Credit for many is given, but many others are unacknowledged, leaving the erroneous impression that all the latter are original with the book.

We are somewhat disappointed with the chapter on collecting, preserving, and rearing. Although most of the published notes have been brought together, the chapter is too much a clipped one, and many well-known points unpublished are omitted. For example, Prof. Riley's description of his breeding-cage, published no less than fifteen years ago, is reproduced with its accompanying figure, while no word is said of the later improvements which Prof. Riley and others are using, and with which the author was familiar. Similarly, in the matter of inflating larvæ, no mention is made of the tin ovens generally used, or of the method recently described of inflating several larvæ simultaneously.

The short family characterizations given in small type will be useful in many instances, but it seems to us a mistake, and a certain discouragement to the student, to insert such definitions as those given on page 126, under the Diptera, viz.:—

Family Asteidæ.—Front bristle above.

Family Phytomyzidæ.—Front bristly.

Family Agromyzidæ.—Front with strong bristles.

It also seems to us that in a work of this character strict uniformity in sub-family terminations should have been followed, whether previously adopted by other authors or not.

But we have found enough fault. We anticipate that the book

will do a great deal of good. Many teachers, we know, will heave a sigh of relief upon seeing it, and we have no doubt but that its sales will be gratifying both to the author and to the clear-sighted publishers.

AN INTRODUCTION TO ENTOMOLOGY.—By the time this number of the NATURALIST reaches its readers, the first half of an elementary text-book of Entomology, prepared by the editor of this department, will have been published.[1] This part includes the grammar of the science, and half of the systematic part. It contains many original illustrations, drawn and engraved by Mrs. Comstock. The following extract from the preface of this work will indicate the author's plan of treatment of the subject:

"This work has been prepared to meet the demand for a text-book which shall enable students to acquire a thorough knowledge of the elementary principles of Entomology, and to classify insects by means of analytical keys similar to those used in Botany. By means of the keys the student can readily determine to what family any insect of which he has a specimen belongs. In many cases tables of genera are also given, and the more common or conspicuous species in each family have been described.

"Although much pains has been taken to render easy the classification of specimens, an effort has been made to give the mere determination of the names of insects a very subordinate place. The groups of insects have been fully characterized, so that their relative affinities may be learned, and much space has been given to accounts of the habits and transformations of the forms described. As the needs of agricultural students have been kept constantly in view, those species that are of economic importance have been described as fully as practicable, and particular attention has been given to descriptions of the methods of destroying those that are noxious, or of preventing their ravages.

"The pronunciation of the technical terms has been indicated by marking the accented vowel, and at the same time indicating its length *when the term is pronounced as an English word.*"

SYNOPSIS OF NORTH AMERICAN DIPTERA.—All North American students of Entomology will welcome the work just published by Dr. Williston.[2] This work consists chiefly of analytical keys and characterizations of families. There is an introduc-

[1] An Introduction to Entomology, by John Henry Comstock, Professor of Entomology in Cornell University, and formerly United States Entomologist. Published by the author, Ithaca, N. Y. Part I. $2.00.

[2] Synopsis of the families and genera of North American Diptera, with Bibliography and new species, 1878–1888, by Samuel W. Williston. 8vo., pp. 84. New Haven, J. T. Hataway. $1.60.

tion, in which the terminology of Diptera is given; then follows an analytical table of families, and, except in the case of the Nematocera and Muscidæ, tables of genera are also given. There is appended to the work a Bibliography of the species described since the publication of Osten Sacken's catalogue. The whole forms a very convenient manual, and it cannot fail to stimulate the study of this much neglected order.

EMBRYOLOGY.[1]

NOTES ON THE DEVELOPMENT OF HOLOTHURIA.—The following interesting facts are taken from a note, not intended for publication, which was addressed to Prof. W. K. Brooks from Mr. Charles L. Edwards, who has been investigating the development of *Holuthuria* at Green Turtle Key, Bahama Islands. As they refer to a type with an abbreviated development within the egg, it has been considered desirable to reproduce them.

"I tried artificial fecundation for some time without result. Then putting males and females together in a tub I could get no fertilized eggs. Finally, about two weeks ago (Aug. 1st), I arranged a live box, as recommended by Selenka, and with excellent results. I have since had no trouble in gathering fertilized eggs and upon four occasions. These Holothurians prove very interesting. The egg is quite opaque, but I have made out the following general conclusions from surface views, but as I have not yet had the eggs just at fertilization, for the animals do not generally discharge the eggs until five or six hours after being put into the box, I have not the exact age of the stages.

"The segmentation is regular and is completed in about seven or eight hours. The blastosphere is formed in about twelve hours. Then gastrulation takes place. Then follows a very complex development within the egg-shell. To all appearances the embryo passes through the Auricularia stage of free-swimming Holothurian larvæ. It then takes the form of the adult, develops five oral tentacles, and so formed, bursts forth from the shell about the fifth day and creeps about on the bottom of the dish. It has developed the beginnings of the spines in the egg, and these with tentacles now grow rapidly during the free larval state. On the sixth day a tentacle arises at the posterior end which grows rapidly, until on the eighth day it is longer than the oral tentacles. About this time a favorite attitude of the larva is to erect itself on the posterior

[1] Edited by Prof. Jno. A. Ryder, Univ. of Penna., Philadelphia.

tentacle, or more properly, I suspect, ambulacral foot, and wave the oral tentacles about. Of course this attitude is not held long, the creeping position, using all the tentacles or feet being most usual. On the eleventh day a seventh tentacle, and on the fourteenth an eighth tentacle appears; the former from about the middle of the ventral surface, and the latter at the base of the oral tentacles on the ventral side. In the meantime the spines have been getting longer and their bases branching in various rosette forms. I now have several larvæ fifteen days old getting along nicely, and from the four lots of eggs have saved forty-three vials of embryos, and so will probably get a complete series, as each set were no doubt fertilized at different times of the day and in any one lot the individuals do not develop evenly.

"These embryos seem to be intermediate between Kowalevsky's, where the adult state is attained without a metamorphosis, and the one described by Selenka. Of course I cannot tell what goes on inside the shell those four or five days after gastrulation and before the larvæ develops tentacles, as the egg is so very opaque. I should have said also that at first the eggs are brown, in a few days they show green pigment spots, and these increase until the free larva is quite green.

"In two or three weeks I shall probably have an abundance of material for sectioning and then I want to take in hand the case of the brown *Clypeaster*, common about here. I am getting fond of the study of the Echinoderms and shall work on them as I get opportunity.

"We came across the birth of an extraordinary zoological myth out here a few weeks since. One of the leading citizens, who is also the school-master, had made a discovery. Whereas they had always thought that the sea-stars come from the sand or from the big stars up above, now they had found the real source 'for true' as they put it. They told us of it and we thought we should be able to surprise the world with a borrowed discovery! But alas! they took us down to the shoal, broke open the *sand-dollars* and pulling out 'the creature' showed us the wonder—*their* young sea-star! They supposed that this young sea-star stayed in these old shells until grown and could hardly believe us when we told them that it was a live *Clypeaster!*"—*C. L. E.*

ARCHÆOLOGY AND ANTHROPOLOGY.[1]

The American Association for the Advancement of Science held its thirty-seventh annual meeting at Cleveland, Ohio, August 15th to 21st, 1888. The meetings were held in the Central High School, which, though some distance from the hotels, had good street-car communications. The building was admirably suited to the needs of the Association. The rooms were ample both in number and size, while the auditorium, large enough for all general meetings, could be darkened for afternoon lectures with lantern views.

The citizens of Cleveland took great interest in the meetings and the local committee made every arrangement possible for the comfort and convenience of visitors. The ladies in charge of entertainments, receptions, etc., devoted themselves to these duties during the entire week and were eminently successful in everything they undertook. Lunch was provided daily in the basement of the building. Thursday afternoon was devoted to receptions given by the citizens at their homes, and some of the magnificent and luxurious residences on Euclid Avenue were thrown open and the members of the Association hospitably received.

SECTION H.—ANTHROPOLOGY.

Dr. C. C. Abbott, of Trenton, N. J., was president of this section, with Dr. Frank Baker, of Washington, D. C., secretary. The meetings were well attended and much interest was shown in the proceedings. The section was kept busy with the reading of the thirty-two papers and their consequent discussion, closing only late in the afternoon of the last day. The session of Wednesday, August 15th, opening day, was devoted to the presidential address, "Evidences of the Antiquity of Man in Eastern North America." Dr. Abbott reviewed the discoveries of paleolithic implements made on this continent, devoting himself principally to those made at Trenton, N. J., by himself; at Little Falls, Minnesota, by Miss Franc E. Babbitt in 1875; and in the Valley of the Little Miami at Loveland, Ohio, by Dr. C. F. Metz in 1886, and the continuation thereof down to the present summer by himself and Mr. Wilson. The finding of the obsidian spear point by Prof. W. J. McGee in the quarternary deposits of Lake Lahontan, Nevada, was also noticed. He concluded from the evidence, first, that paleolithic man did not become extinct, and second, that his descendants attained an advanced

[1] This department is edited by Thomas Wilson, Esq., Smithsonian Institution, Washington, D. C.

degree of culture in the land of their forefathers. "We might maintain that we have his descendants in the Eskimo, and that they were finally driven north by the Indian, who, as is conceded by all students, migrated hither at a period, which, archæologically considered, was not exceedingly remote."

He devoted a portion of his address to a consideration of the date of the paleolithic period in America, and cites Rev. G. F. Wright of Oberlin, Ohio, thus: "To say that man was here before the close of the glacial period only fixes a minimum point as to his antiquity. How long he may have been here previous to that, must be determined by other considerations. The term 'close of the glacial period' is itself an indefinite expression. The glacial period was a long time in closing, theerosion of the Niagara gorge began at a time long subsequent to the deposit of gravel at Trenton and at Madisonville. Between these two events a sufficient time must have elapsed for the ice-front to have receded a hundred miles or more, or all the distance from New York to Albany, since only at that stage of its retreat could the Niagara river begin its work. The deposits at Trenton and Madisonville took place while the ice-sheet still lingered in the southern water-shed of New York, Pennsylvania and Ohio." Dr. Abbott concludes, "There was a time when, to all appearances, American Archæology would have to be squeezed into the crammed quarters of ten thousand years; but we are now pretty sure of twenty or even thirty thousand years in which to spread out in proper sequence and without confusion, the long train of human activities that happened during prehistoric time. If we accept the most moderate estimate of the length of postglacial time, some 6,000 years, we have an interglacial time (that is, between the first and second epochs) from 18,000 to 60,000 years, and to this must be added the long stretch of time during which the second epoch of cold continued. Assuming that geologists have made no mistake, archæology has time enough and to spare. At no period was the continent uninhabitable, however thick or wide-reaching the ice, or deeply submerged the lower lying areas. There was still land enough for all the mammalian life of that period, and it flourished at the foot of the advancing ice-sheet and re-entered every track as the glaciers withdrew. In that time we had the mastodon and mammoth, reindeer and bison, musk-ox and moose, and the man of that period was familiar with them all."

A general session of the Association was held in the evening to hear the retiring president, Prof. S. P. Langley, Secretary of the Smithsonian Institution, deliver his address, entitled, "The History of a Doctrine." The "Doctrine" was that of Radiant Heat or Energy. This address was profound and very learned, and yet by his incisive style of writing and dignified delivery, the Professor made it easily

understood by a popular audience. It is published in *Science* for August 17.

Thursday, August 16th. — "Certain prehistoric ornaments found in Mississippi," by Prof. R. B. Fulton, of the University of the Mississippi. He presented about thirty prehistoric beads from Lincoln county, Mississippi. The material was jasper, reddish-brown, mottled with a lighter shade and very hard. Their forms were cylindrical, and also of the shape of deer and birds. They were all, or nearly all, polished and drilled. Prof. Fulton said he had never seen any similar beads except those in the Smithsonian exhibit now open at the Centennial Exposition at Cincinnati. Mr. Wilson said he had prepared that display and had chosen those from the many in the National Museum to show a series descriptive of the method and work of the drilling of these hard substances by the prehistoric man.

Dr. Frank Boas, the editor of *Science*, New York city, delivered a learned address on the "Development of the Civilization of Northwest America." He raised a query as to the possibility of establishing a connection between Asiatic and American tribes, and noted many indications of relationship, and said the Indian tribes of the northwest coast of America far excel their neighbors in arts and industries. The tribes of the northwest coast belonged to many linguistic stocks. In British Columbia alone were eight distinct tongues. He spoke of the striking similarity of physique between certain tribes of the northwest coast with certain Asiatic tribes. The customs and legends of these tribes were much alike, but in their myths the speaker found the greatest coincidence. His paper, though replete with facts, was but little more than the announcement of his theory, and he closed as follows: "But before drawing further conclusions we must analyze the civilization of northwest America in order that we may know what we have to compare. Only after this is done can a study of the numerous striking analogies be successful in demonstrating the Asiatic origin of these northwest tribes."

This speaker used the term nation as synonymous with people, and civilization as synonymous with culture, to which Major Powell took exception.

The Rev. W.H. Beauchamp, of Baldwinsville, N. Y., read a paper, "The Onondagas of To-day." This was almost a complete history of this tribe as it exists at present, and has existed during the present century. They now number about four hundred. They have forgotten their own earlier history, and their traditions are uncertain, contradictory, and valueless as history. Illustrations of this were given by the dozen.

The speaker gave his own recollections of the Onondagas and of their manners and customs during fifty years past. He described

their feasts, their marriages, their wampum, their amusements, and their modes of life.

Dr. D. G. Brinton read a paper on "The Alleged Mongolian Affinities of the American Race," in which he demonstrated that no such affinities existed. His conclusion was the opposite of that of Dr. Boas. An abstract is as follows:

Many recent writers assert that the American or Red race presents various traits which bring it into close relationship with the Mongolian. These alleged resemblances may be classed as either of language, of culture, or of physical appearance. In language the Eskimo has been said to resemble Ural-Altaic tongues of northern Asia; and the Otomi of Mexico has been asserted to be monosyllabic and isolating like the Chinese. Both these statements are proved erroneous by recent researches. The American languages differ entirely from any of the Mongolian group.

In culture there are various similarities but not more, and not other, than can be pointed out between any two groups of early civilizations, and no one of them is evidence of intercourse.

The physical similarities relied upon begin with the color of the skin. But no American tribe shows the peculiar hue of the Mongol. The hair, though straight in both races, differs in color and to some extent in shape of cross section. The oblique or "Chinese" eye is by no means usual in the American race, scarcely more so than among the whites, and is, moreover, of much less importance than has been maintained. The shape of the skull is markedly different. The Mongolian head is round, that of the Eskimo is notably long, and of other tribes mixed. The nasal index of the American Indian approaches that of the modern European much closer than it does the Mongolian. There is in certain tribes some general physiognomical resemblance, and this is all upon which can be based the alleged Mongolian affinities of the American race; and this is of but slight importance.

The discussion on this paper was most animated, although it almost immediately left the subject.

Prof. E. S. Morse, of Salem, Mass., supported the speaker. Mr. Horatio Hale, of Toronto, made some observations, as did Prof. Mason. Major Powell dilated upon the importance of language, and told how it alone was the true test of racial affinity. He described man in the paleolithic period as having spread over and occupied almost the entire world; he said the evidence of his existence and occupation were certainly to be found on every continent. And he described the formation of language by the man of the paleolithic period. He showed how different modes of speech were begun and different dialects grew. He asserted the tendency of man to be, to consolidate and reduce the number of his languages rather than to divide and extend them.

Prof. Morse said this would make a different language for every fish-pond around which the prehistoric man assembled, and denied the value of language in determining racial affinities in prehistoric times.

Major Powell answered by declaring his theory of language as a racial test had no application to man earlier than we had knowledge of his language.

Dr. Brinton sought to close the discussion by saying that different races might employ the same language, and that according to his theory, Major Powell could prove, what we know from history and from our senses to be an absurdity, to wit: that because they spoke the same language, the white and the black man now occupying the United States belonged to the same race.

Major Powell had the final word to say that his opponents had constructed a man of straw that they might enjoy the pleasure of thrashing him. His own position was, that in the beginning all men sprang from the same stock, or if not, they at least found themselves in the same condition; that there were then no distinct or separate races of men, and that the divisions and subdivisions of race, blood, language, culture or physique had been accomplished little by little, and they had thus finally developed into the different races with their different languages and cultures. But that they still all shaded off into each other and ran together; and, whether counted sideways through the collateral branches in the present day, or counted backwards, each through his own ancestors, it was impossible to find an exact dividing line between races. So all the world was now, as it ever had been, akin, of one race and one blood; and that the subdivisions into races was but arbitrary; the work of man and not of God.

This discussion was the most impetuous and interesting of any in the section. The speakers were able, ardent, fluent, and at times, Major Powell especially, arose to eloquence.

Mr. Hilborne T. Cresson was down for two papers, but he was absent and they were read by abstract. They related to his discovery of two paleolithic implements found by him in what he calls modified drift, one on the east fork of White river, Jackson county, Indiana, and the other in the Trenton gravels, but on the Pennsylvania side of the Delaware river. Cuts of the implements were shown but the implements themselves were not present.

Friday, August 17th. — Colonel Garrick Mallery, of the Bureau of Ethnology, Washington, D. C., read a paper entitled "Recent Discovered Algonkin Pictographs." Colonel Mallery has been engaged for ten years in the investigation of the sign language of the North American Indian, and is the highest authority on the subject. Colonel Mallery has just returned from a month's visit among the Micmacs of Nova

Scotia and around the Bay of Fundy. He had discovered many new pictographs, tracings of which he had taken and presented to the audience. The lecture-room was decorated with these and other specimens in a manner highly interesting. Colonel Mallery told of the investigations and discoveries made by himself and Dr. W. J. Hoffman, and of their comparisons of the real objects with the descriptions made by Schoolcraft in his voluminous publications issued in 1853, and showed that he (S.) had fairly represented the substance, but sometimes with exaggeration. The principal part of Colonel Mallery's paper was devoted to a description of the signs and symbols which were on the charts, and to a translation of their messages.

Remarks were made by several persons commendatory of Colonel Mallery's labors. Prof. Mason said: "We have before us to-day a record of the beginning of a written language. We are standing in the presence of the birth of literature." And he asked a vote of thanks to Colonel Mallery.

Prof. J. E. Todd, of Tabor, Iowa, presented the next paper, entitled "Some Ancient Diggings in Nebraska," which he illustrated by a sketch upon the blackboard. These were at Newawka on the Weeping Water creek. They were supposed to be pits dug for the extraction of flint. They bore some resemblance to the quarry at Flint Ridge, Ohio.

Dr. D. G. Brinton presented "Early Man in Spain." He dealt first with the chipped flints discovered by Ribera at Otta, which were believed to come from the miocene. He said the implements of the neolithic period in Spain have a striking similarity in size and form with those common to the United States.

The Basques are the most ancient known inhabitants of Spain and Portugal. They are believed to have lived there at the time of the formation of the shell-heaps, which seem older here than in Denmark. The Basque language has many peculiarities of the typical American Indian tongue, such as the Algonkin. Dr. Brinton exhibited a map on which the six hundred fathom line of the Atlantic ocean was indicated. An upheaval of the land to that altitude would join the continent of Europe with that of North America by way of England, Scotland, the Faroë Islands, Iceland, Labrador, and the New England coast. Many things seem to confirm this theory, which is an opinion held by many geologists. The existence of this land-bridge across the Atlantic ocean once established, many ethnologic problems relating to the American Indian would be at once solved.

Mr. Wilson complimented Dr. Brinton upon his paper and continued in the same line. Speaking of the endurance of languages he said the Basque language was still spoken in France and Spain, and there were many persons now living there in the retired rural

districts who could speak no other. The aged couple who occupied the house at the entrance of the cavern of Laugerie Basse, excavated by M. Massanet, speak only the Basque language, and any one visiting there must take with him an interpreter who speaks French and Basque.

On the other hand, the language of the Normans, who came as invaders and settled permanently in that province in the north of France which bears their name, had entirely died out. It never established itself as a separate language, but joining itself to the French made a dialect, a bastard language, which was neither the one nor the other. The Gallic language brought from Wales or Cornwall into Brittany had survived side by side with the French and continued as a separate language in spite of all efforts of the government to root it out. It was now a law of France that none of these ancient languages, at once foreign and indigenous to France, shall be taught in the public schools.

Mr. Wilson described the dolmens, menhirs, and other monuments of Spain and France and told something of the efforts made to rescue and preserve them.

Mrs. Anita Newcomb McGee, wife of Prof. McGee, of Washington, D. C., read the paper of the afternoon, entitled "American Communities." This lady had one of the largest audiences of the entire meeting. She was listened to with close attention and received many congratulations. She described in detail with the necessary statistics, the seven principal communistic societies which had been established during the past century in the United States. Her arguments were fairly made and her deductions correct. She did not undervalue a benefit, nor overstate an objection, yet she said she was forced to the conclusion that communism could not permanently rival independent competition. She closed with three fundamental objections to, or causes for failure of communities.

1. A community does not admit that wide differentiation of labor and variety of occupation which is found outside, and is considered a sign of progress.

2. A community is an institution intermediate between the individual and the State, and is antagonistic to that other more natural intermediate institution—the family. This has been felt by community founders, and they have tried three methods of disposing of the family. *A.* Abolishing it by celibacy. The climax is here rapidly reached, and after, it is impossible to prevent a steady decrease in numbers. *B.* Abolishing it by complex marriage. This is a logical settlement of the rivalry between community and family, *i.e.*, making the two one, but it so pronounced a return to conditions long abandoned in the course of evolution, that later or monogamic instincts (now normal) refuse to be suppressed, and finally cause the failure of this attempted solution. *C.* The reten-

tion of the family, which means one community within another. Each person has then two interests to serve, and in the often necessary choice between them, he cares for his own family, even though it be sometimes to the detriment of the higher circle—the community.

3. The essential object and aim of Communist and Socialist alike, is equally to support and reward the worthy and unworthy, the practical effect of which is to suppress all stimulus to labor, and to reduce all men as far as possible to a dead level of mediocrity.

That form of social organization, however, which tends to produce the ablest men and stimulate them to highest efforts must, other things equal, make the greatest progress in social evolution. Communism is satisfied with mediocrity, and here is its weakness. On the other hand its strength lies in its unity of interests—that is, in its element of co-operation.

Saturday was devoted to an excursion given by the local committee to members of the Association. The steamer "City of Cleveland" left her dock at 8 A.M. well filled with passengers. Her first stop was at Kelly Island, where, under the guidance of Prof. Foote and Mr. Severance, the visitors were conducted to the great glacial groovings in the solid rock which had been exposed to view for the purpose of this visit. The steamer then continued to Put-in-Bay. Everything possible was done by the committee to make it a day of pleasure. The day was superb and the lake smooth as glass. Concerts were given on board, and amusements, scientific and dexterous, were the order in the smoking-room. The steamer returned at sundown.

Monday, August 20th.—Mr. A. Wanner, of York, Penna., Principal of the High School, exhibited some unfinished banner stones from the Susquehanna river, and read a description of the methods by which they were made, which is being prepared for publication in the NATURALIST.

Horatio Hale, Esq., of Clinton, Ontario, read an elaborate paper, subject, "The Aryan Race, Its Origin and Character," which is being published in *extenso*.

Mr. J. W. Smith exhibited some mound-builder relics from Iowa.

Prof. F. W. Putnam described the Serpent Mound of Adams county, Ohio, and its surroundings. This lecture was delivered in the auditorium and was accompanied by photographs of the mound, showing its restorations and the various explorations in its immediate neighborhood by means of lantern views projected upon the screen.

Prof. Wm. Libbey, Jr., of Princeton College, described "Some of the Characteristics of the Yakutal Indians of Alaska." He compared the strength of the men who spent their time in hunting and fishing and amusements with that of the women who did all

the labor. He mentioned their aptness in mechanical arts and their strict idea of property. They were highly superstitious and did many things to secure good fortune. A whole tribe would get baptized by the missionary in order to change their luck, and when their luck did not change the missionary had to. Their numbers were diminishing, but this was due principally to changes in diet and clothing, for in that climate the canned beef and cotton overalls of the white proved but poor substitutes for seal-fat on the inside and sealskin without.

Dr. D. G. Brinton, of Media, Penna., described some "Traits of Primitive Speech." His abstract was as follows:

Language was not born in a day. Primitive utterance was of course not the same everywhere. By studying languages which have suffered least by contact with others we can catch some glimpses of the character of man's earliest significant utterances. I begin with some observations on the phonetic elements. In all European tongues the mere letters of the alphabet have no meaning. Their value in a word is fixed. Arranged in a word they convey its sound and sense. Judging by certain American examples this was not the case in primitive speech. In referring to the Tinne language Bishop Farrand asserts that in primitive speech "a" expressed matter, "e" existence, "i" force or energy, "o" existence doubtful and "u" existence absent. These vowels were put in action by single or double consonants. These consonantal sounds were sixty-three in number. The labials expressed the idea of time and space, the dentals the termination of force, the nasals motion in repetition, the gutterals motion in curves, the "h" ideas of command. The Cree language, to quote from the same authority, resembles the Tinne no more closely than does the French the Chinese. Nevertheless, the same peculiarity of materially significant phonetic elements is discovered. I find but little, yet some, evidence in the different groups of American tongues in favor of the theory which maintains that there is some fixed relation between sound and sense in the radicals of languages. "N" expresses the notion of the *ego*, or myselfness in many languages. "K" is associated with the idea of otherness. In many American languages the phonetic elements are vague and fluctuating. In referring to the Klamath language Dr. Behrend writes: "The same person pronounces the same word differently and when his attention is called to it he will insist that it is the same." Some of the consonantal sounds are not true elementary sounds, but in primitive languages had to have some other consonant associated with them. Phonetic elements were often inadequate to express the idea. In the Indian languages, emphasis, action, and modification of the vocal expressions seem to have constituted an essential part. The stress laid on a vowel sound often alters its meaning. In the domain of lexicography,

primitive speech presents a very curious phenomenon. In Tinne the same word may express good or bad, high or low. In Cree the union of opposite significations reappear in the ultimate rudiments of the language and numerous series of opposite ideas are developments from the same original sounds. The gradual development of grammar is strikingly illustrated in these languages. Subject, verb, direct object and remote object were all expressed in one word. Primitive words expressed being in relation, and hence partake of the nature of verbs. Primitive man did not connect his sentences. They followed one another disjointedly. Relative pronoun and conjunction are absent in American languages. Few American tongues have adjectives. The question has arisen did primitive man model his sounds after what he heard or what he saw? The former opinion has been most popular. His earliest sounds seem to have been expressive of motion and rest, energy and its absence, space and direction, color, form, and the like.

Tuesday, August 21st.—Horatio Hale, Esq., read a paper on "An International Language," for scientific and other purposes. In this he dissected the Volapük and showed its many errors. He advocated a language founded upon a more scientific basis. His paper is published in *The Critic*, N. Y., of August 25.

Mr. Wilson doubted the success of the experiment and expressed his belief that no new language could be impressed upon the people by any vote or decree however authoritative. He cited the persistency of the Basque and Gallic languages in France and the many dialects extending over all Europe; and this in spite of all efforts to uproot or consolidate them. He thought a common language might be established between the people of different countries by the different governments uniting in the choice of a language (one of the living ones), to be taught in the schools of the country. We Americans could adduce many arguments why English should be chosen as the common language. But suppose the governments should be unable to agree upon it and German should be chosen. Then in all English-speaking countries there would be taught in the public schools English *and German;* in France, French *and German;* in Italy, Italian *and German;* in Spain, Spanish *and German*, and so on. Thus every one would be able to speak his own language and a common language which every other person of whatever nationality would also be able to speak.

Prof. MacFarlane elaborated with approval Mr. Hale's method, and commented upon the defects of Volapük. The discussion was continued by Prof. Mason and Dr. Brinton.

To be continued.

MICROSCOPY.[1]

THE EGGS OF AMPHIBIA.—I have found *hypochlorite of sodium* an excellent solvent for the gelatinous envelope of the amphibian egg. I obtained a ten per cent. solution, and diluted it with five or six times its volume of water. The eggs are first hardened by heating, or by immersion in some preservative fluid; then placed in the Labarraque solution until the gelatinous envelopes are so far dissolved that the eggs may be easily shaken free. They are then washed and preserved in alcohol. This method works perfectly with the eggs of Necturus, and has given equally good results with the eggs of the frog. The time required for dissolving the envelope in the case of Necturus is about five minutes. Care should of course be taken not to leave the eggs exposed to the solvent longer than is necessary in order to destroy the envelope.

EXPERIMENTS WITH CHITIN SOLVENTS BY T. H. MORGAN.[2]—The first experiments were made upon the eggs of the common cockroach, and the selection turned out to be a most fortunate one. A great many eggs are laid at one time, the whole number being surrounded by a stiff chitinous coat, forming the so-called raft.

The solvents used were the *hypochlorites of sodium* and *potassium*, recommended by Dr. Looss in 1885.

The most successful experiments on the cockroach's eggs were as follows:

1. The rafts were placed, in a fresh condition, in a weak solution of *eau de Labarraque* (commercial fluid diluted with five or six times its volume of water), and left until the chitinous envelope became soft and transparent. The time varies; if *slightly warmed* the time is less, for the warm solution perhaps thirty minutes to one hour; but one must go more by the appearance of the chitin than by any definite time. If the embryos are far advanced they may now be removed from the envelope one by one; if still young, they had better be hardened and cut altogether. In both cases the eggs or embryos were next washed for a few minutes in water, and then transferred for an hour to picro-sulphuric acid, then as usual they are passed through the grades of alcohol, 70 per cent., 80 per cent., 95 per cent.

[1] Edited by C. O. Whitman, Director of the Lake Laboratory, Milwaukee.

[2] Studies from the Biological Laboratory, Johns Hopkins University, Vol. iv., No. 4, p. 217, 1888.

2. To specimens which have been already hardened and preserved the solvent may also be applied; but in all cases where fresh material is easily obtainable, it should immediately have its chitin softened and then afterwards be preserved. Here the method is somewhat shorter, since the substance has been previously hardened. From alcohol—weak solution—they are put into the Labarraque and softened as above, then passed through water and the alcohols, etc.

In most cases in which an animal egg or embryo is encased in chitin, the best results have been obtained by staining the sections after they have been cut and fixed to the slide. If the specimen is small, staining *in toto*—after having the chitin softened, or if before this has taken place, after having made an entrance through the chitin with a point of a needle—is equally good. The greatest difficulty, and practically the only one which one meets with, is that the Labarraque solution not only attacks the chitin itself, but after a time the soft tissues of the animal—apparently the connective tissue. Where the chitin surrounds the object completely, as in the case with the roach's raft, one can remove the object from the solution as soon as the chitin is softened, and before the underlying parts have been attacked. In cases like this the solvent is at its best.

Very often, however, the soft tissues of the animal are exposed in places between the chitin covering. This is well illustrated by the joints of insects' legs, etc., and very frequently these exposed places are attacked before the chitin is completely softened, thus causing the joints, if much handled, to fall apart.

By judiciously diluting the solution and taking the parts to be softened from it before the joints are attacked, one will find its application practicable even here.

The greatest difficulty of all is when the chitin is internal, completely surrounded by soft tissue. So far as I have made any experiments here, I find that one gets better results with very dilute solutions—diluted from eight to ten times, or even more. It must be admitted that in this last case the application of the solvent is more doubtful, and of not nearly so much service as in the first and second supposed cases.

Strong solutions, then, had better be used only when the chitin completely surrounds the soft animal parts, and dilute solutions must be used in all cases where these latter substances are exposed. The solution not only softens the chitin, but *removes all pigment* either in the chitin or in the tissue beneath, and this is at times advantageous.

THE USE OF CELLOIDIN IN MAKING DEMONSTRATION-PREPA-

RATIONS OF THE BRAIN.[1]—Methods of making dry preparations of the brain for purposes of demonstration have been recommended by Giacomini, Laskowski, Broca, Duval, Schwalbe, and others. The method employed by Dr. Lenhossék of Budapest differs from all these, as the preparations are to be kept in alcohol, except when used for demonstration. For this purpose, they are removed from the alcohol and carefully dried in soft linen. They bear handling well, and are not injured by an exposure of two hours. They begin to shrink, however, if not returned to the alcohol after the lapse of this time.

Preparation.—1. Alcohol supplies the best means of hardening, as it well preserves the color and form. If other reagents are employed, such as zinc chloride, Müller's fluid, etc., the preparation must lie in alcohol awhile before further treatment.

2. The hardened preparation is removed from the alcohol, made dry superficially by careful application of soft linen, and then coated with a thin layer of celloidin, applied with a fine brush. The celloidin is dissolved in a mixture of equal parts of strong alcohol and ether, as for imbedding. The furrows are not to be filled with the celloidin solution, but the walls must be carefully and thoroughly painted. In order to keep them open during the process of hardening, it is well to fill them with cotton or with blotting-paper.

Within five or ten minutes the celloidin dries to a thin, transparent, tough membrane, which protects the preparation and gives it greater firmness.

DRY PREPARATIONS OF THE BRAIN.—The method of impregnating the brain with paraffine was first employed by Fredericq,[2] in 1876. Schwalbe[3] adopts essentially the same method for the human brain, proceeding as follows:

1. Hardened in zinc chloride or in alcohol.

2. After removing the membranes, cut into a number of suitable pieces, as it is not advisable to impregnate the brain *in toto*.

3. After dehydrating in 96 to 97 per cent. alcohol, soak in turpentine until completely saturated.

4. Impregnate with soft paraffine, kept at 60°C. (five to eight days.

5. The paraffinized preparation is placed on a layer of cotton to cool, care being taken to give it such a position as to avoid deformation.

[1] Michael v. Lenhossék. "Celloidinbehandlung des Gehirns zur Herstellung von Demonstrations-präparaten." Anat. Anz. ii., 3, p. 77. Feb., 1887.

[2] Bull. de l'Acad. roy. de Belg., 2 ser., xl., June, 1876.

[3] Anat. Anz., i., No. 12, p. 322, Nov., 1886.

SCIENTIFIC NEWS.

—EDITORS OF THE AMERICAN NATURALIST:—I have recently had my attention called to an error in my paper on Directive Coloration, and I wish to correct it as far as possible. Please have the following errata inserted where they will accomplish the most in this direction.

Errata.—On page 201, and 10th line of article on Directive Coloration, substitute Wallace for "Darwin."

On the 15th line of the same paper, erase the first five words.

Yours truly,

Tabor, Ia., Sept. 10th, 1888. J. E. TODD.

—A summary of the little that is known of John Abbot, the Natural History artist of Georgia, is given by S. H. Scudder in the *Canadian Entomologist* for August, 1888.

—Dr. Douglass H. Campbell has been appointed Associate Professor of Botany in Indiana University, Bloomington, Indiana.

—Dr. David S. Kellicott has been elected to the chair of Comparative Anatomy and Zoology in the Ohio State University, Columbus, Ohio.

—Dr. Julius Nelson, of Johns Hopkins University, goes to the experiment station established in connection with Rutger's College, at New Brunswick, N. J.

—Mr. George H. Parker has been appointed instructor in Zoology at Harvard University.

—The Western Society of Naturalists will hold its annual meeting October 24 and 25, 1888, at Champaign, Illinois, in the building of the Illinois State University. The presidential address will be delivered by Dr. S. A. Forbes. It is intended to give the meeting a distinctly educational tendency, and to this end essays on the methods of teaching the various natural-history sciences are expected from the members. These, together with the resulting discussions, it is hoped, will prove of considerable interest and value. There will also be papers upon microscopical, physiological and anatomical technique. The local hotels at Champaign and Urbana give rates of $1.50 and $1.00 per day. The headquarters of the Association will be at the Caldwell House, Urbana. The Secretary of the Society is Dr. J. S. Kingsley, Bloomington, Indiana.